

INFORMATION BOOK

HOW THINGS DEVELOPED



MEDICINE

BOSWELL TAYLOR



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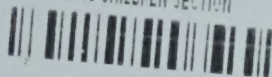
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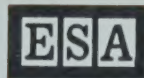
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MEDICINE

Boswell Taylor



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NOTE

On page 97 there is a glossary explaining several medical words. These are printed in SMALL CAPITALS when they first occur in the book.

CHAPTER ONE

The Mystery of Medicine

IF a dog is feeling unwell it will find some grass to chew. In some strange way the dog knows that grass will act as a medicine.

We have the same instinct. If we cut a finger we instinctively suck away the blood. We do not reason that we are cleaning the wound and that the salt in our saliva is acting as a DISINFECTANT. But that is what is happening.

We are our own doctors in other ways too. If we twist an ankle we rub it to make it well. We rest to cure a headache.

The first men on earth must have had the same instinct. The story of Medicine is as old as Man. There are no records to prove this, although we believe it to be true.

In the Pyrenees, a mountain range between France and Spain, is a cave known as Trois Frères—the Cave of the Three Brothers. One of the cavemen who lived here thousands and thousands of years before Christ was born was an artist who painted pictures upon the walls. One of the human figures is quite clearly a doctor; so here is evidence that there were doctors seventeen thousand years ago.

They were not doctors as we know them today. For one thing they were not doctors alone. They were also priests and magicians. In those very early days in the story of Man, Medicine was not looked upon as the art of making people well. It was mixed up with religion and magic.

We have found some of the tools they used, and also bones to show how those tools were used. From the wall paintings and our

MEDICINE

discoveries in the caves, together with our knowledge of how backward peoples behave, we know what happened long ago.

Illness was very mysterious to primitive man. A man, who was as normal as themselves a little while before, suddenly became strange. He lay down, and twisted and writhed. He sweated, and a moment later, shivered. It was all very strange—and terrifying.

From the beginning, these early men who lived in the caves underground believed that somewhere in the mountains or the skies were gods who ruled their lives. The illness must be their vengeance for some sin. Either a devil had forced some evil thing into the patient's body, or taken away his soul.

The friends of the patient called upon the priest to help. The priest, or the Medicine Man, or the Witch Doctor, or the Sorcerer—all these names were used—pleaded with the gods to help.



*'Medicine Man' drawn in the
Cave Trois Frères, France*

He dressed strangely to drive the devils from the body. He sang, or he danced. He performed some ritual, or did some magician's tricks. All these acts could not influence the disease, but the patient often became well despite them. Then the Medicine Man was praised. If too many patients died, the Medicine Man suffered.

These priest-doctors gradually became cunning. They found that certain herbs helped to cure the patient. They even enlisted the aid of SURGERY. If the devils appeared to be in the victim's head, they cut out a part of the bony skull through which the devil could

THE MYSTERY OF MEDICINE



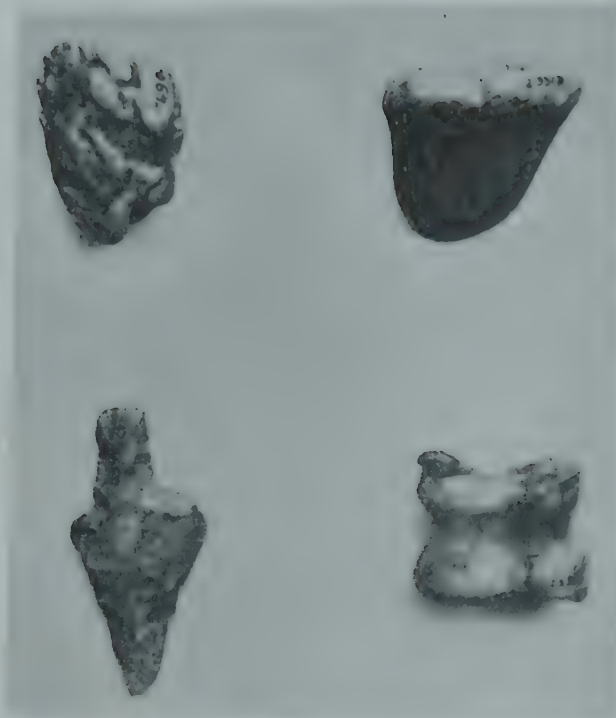
An African Witch Doctor

escape. Flint knives have been found that must have been used for this operation.

Thus, through trial and error, and often with the wrong aims, the art of Medicine grew. Man learnt to make use of Nature's remedies. The skill in surgery was born. Skulls have been found with the TREPANNING wound healed, showing that the patient recovered from the surgical cure.

But through the many thousands of years in the story of Man until quite recent times, Medicine has been linked with magic. Even today men carry potatoes, which, they avow, will cure their rheumatism. Some people think that a coffin nail or a snake's skin will

MEDICINE



TOP LEFT. *Stone rubbed on warts to cure them*

TOP RIGHT. *Stone used as a cure for toothache*

BOTTOM LEFT. *Arrowhead boiled in the water given to sick cows*

BOTTOM RIGHT. *Bone used as a charm against rheumatism*

heal a fever. These are the last remnants of the Medicine Man's magic.

The story of Medicine has not ended, and perhaps never will be. But since those first days in the caves of primitive man, the art has grown. Each civilisation in turn has added to our knowledge.

In the tombs, that are all that remain of the ancient Sumerian civilisation on the banks of the rivers Euphrates and Tigris, have been found tablets with medical rules, and a doctor's seal that was used five thousand years ago.

But the Babylonians have left us even more. They had a king, called Hammurabi, who drew up a list of medical laws for all his people to keep. He wanted to be sure that his physicians did not charge too much. He also wanted to make sure that they did their job well. This was one of his laws:

"If the doctor shall treat a gentleman and shall open an abscess with a bronze knife and shall preserve the eye of the patient, he shall receive ten shekels of silver."

THE MYSTERY OF MEDICINE

The doctor received less to treat a slave, but then his penalty for a mistake was not so severe. He replaced the slave instead of being punished.

There were many other laws in this Code. King Hammurabi was anxious for everyone to know the Code, so he had it carved out of a hard stone and set up in a temple in Babylon. The temple has long since crumbled into dust, but the tablet of hard stone with its Code of laws can be seen today in the Louvre, in Paris.

If Babylon has the honour of making the first medical laws, it was Egypt which provided the first God of Medicine. This was Imhotep, who was a builder as well as a famous court physician. After his death, pride in his work grew until he was made the Egyptian God of Medicine.

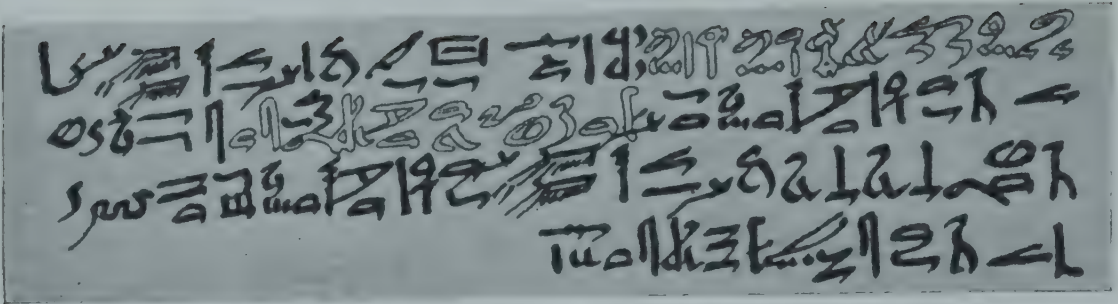
Another Egyptian doctor has left a monument to his fame. This was Sekhet'enanach, a PHYSICIAN to one of the kings, or Pharaohs as they were called. He healed the Pharaoh's nostrils, and this deed is recorded upon a carving in honour of his master. The stone carving can still be seen today for all to read.

Even more important than this record of a single OPERATION are some papyrus books which we have found. One is known as the Ebers papyrus, and the other is named after the American who found them both, Edwin Smith. At one time only the Ebers papyrus could be studied, Edwin Smith had locked the other



Statuette of Imhotep

MEDICINE



Recipe from the Ebers Papyrus. It reads: Specific for driving away all kinds of spells. A large beetle, cut its head and wings off, heat it, laid in fat, lay it on. If you then want to drive it out, heat its head and its two wings, laid in snake's fat, heat it and let the man drink it.

one away in his collection. As the Ebers book mainly consisted of charms and magic, people thought that the Egyptians had very little real knowledge of medicine. When Edwin Smith died, the second papyrus was read, and people could see how wrong they were. The Edwin Smith papyrus dealt with surgery, and very sensible and wise it is too.

If you followed the treatment suggested for a DISLOCATED jaw you would not go far wrong.

"You should put your two thumbs upon the ends of the two RAMI of the MANDIBLE inside his mouth and your fingers under his chin and you should cause them to fall back so that they rest in their places."

The Egyptians knew very little about ANATOMY considering the number of dead bodies they preserved. They believed that when a man died he went to another world taking the things he owned with him. So they buried their great men in large pyramids of stone. But it was necessary to preserve the dead body by EMBALMING it. Perhaps the reason that the Egyptians knew so little about anatomy despite this was that the men who did the embalming were despised. They were paid well, but when they had done their work they took their money and fled.

But they did their work well. Now we are able to study these

*FAMOUS CENTRES IN
THE HISTORY OF MEDICINE*



MEDICINE

mummies, as the dead bodies are called, and from them we know what the Egyptians were like more than three thousand years ago. The marks and results of many diseases can be seen in the embalmed bodies today.

GOUT, TUBERCULOSIS, APPENDICITIS and RHEUMATISM are all diseases that people suffer in Britain today. Doctors were trying to find the cures for those self-same ills four thousand years ago and more. Some of the Egyptian mummies not only show signs of the illnesses, but also possess marks to show attempts at a cure.

Although they did not practise embalming, the Hindus knew far more about surgery than the Egyptians. They used bamboo SPLINTS for FRACTURES. They liked to perform operations. They were, in fact, the pioneers of PLASTIC SURGERY. One of the punishments dealt out to criminals was the slicing off of the poor man's nose. When released the criminal hurried to a doctor. The surgeon made a pattern of the nose. He cut away the skin from the cheek or forehead and made it into the shape he wanted. Then he stitched it into place.

The Hindus knew the value of nurses. They wrote books telling the nurses about their work, and reminding them of their importance:

"The physician, the patient, the medicine and the attendants (nurses) are the four essential factors of a course of medical treatment."

The Hindu advice to a girl who wished to be a nurse could be used today:

"That person alone is fit to nurse or to attend the bedside of a patient who is cool-headed and pleasant in her ways, does not speak ill of anybody, is strong and attentive to the needs of the sick, and strictly and unwearily follows the instructions of the physician."

CHAPTER TWO

Hippocrates, the Father of Medicine

THE badge of the Royal Army Medical Corps shows a snake climbing up a staff. The snake has always been accepted as the symbol of medicine. Perhaps this is because it was the emblem used by the Greek God of Medicine whose name was Æsculapius.

There is little doubt that Æsculapius was a mortal and a famous physician before ever the Greeks decided to make him a god. He was a miracle healer rather than a doctor, and did most of his magic at night.

He had a CLINIC in the Temple of Delphi, and there people came to him from all over Greece. He listened to their tale of woe and then arranged for them to sleep all night in the temple.

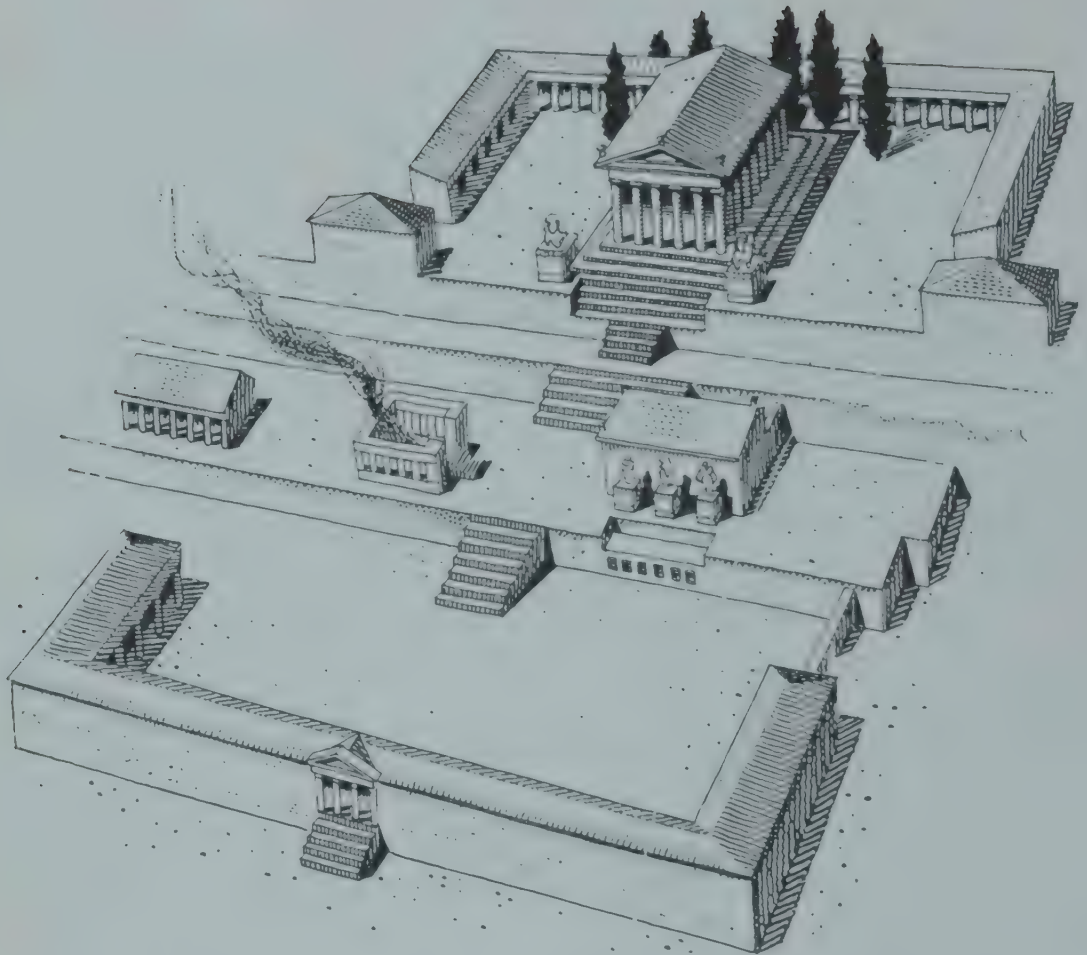
By morning either the patients claimed that they had dreamt the cure or the priests were ready to tell them how their sicknesses could be cured.

Æsculapius lived twelve hundred years before Christ was born. The Greeks had such a high opinion of his work that when he died they worshipped him as a god. They believed that he could do wonderful cures as a god. It was even declared that to cure one man he had cut off his head, turned him upside down to let the sickness drain away, and then put the man's head back on his shoulders.

For more than eight hundred years men worshipped Æsculapius. And during that time they believed that medicine was a gift from the gods, and if a man was ill he could be cured only by praying to the gods.

Then, in 460 B.C. on that same island of Delphi where the temple

MEDICINE



Temple of Æsculapius (adapted from Plate 40 of Paul Schazmann's KOS: VOL I ASKLEPIEION)

of Æsculapius stood, was born a child who was to become the greatest doctor in history: Hippocrates, whom we call the Father of Medicine.

As a boy he must have seen the long processions of believers following the banner of the climbing snake as they went to worship at the shrine of Æsculapius. He must have read the stories of the god's famous cures, which had been carved upon tablets on the temple walls. He must have seen the sick people on their pilgrimage to the temple to dream hopefully of their cures.

HIPPOCRATES, THE FATHER OF MEDICINE

The sick people, thinking only of their pains, could not have known that the boy they passed would, in his lifetime, change the whole idea of medicine.

We know very little about Hippocrates' life. We know that he travelled to many lands on the edge of the Mediterranean Sea. We know also that when he returned he formed a school and lectured to his students beneath a tree. An old tree is still pointed out as the one he used on the island of Cos.

But we know about many of the people he treated. We know the treatment he PRESCRIBED, and whether it was successful. We know all this because it was written down in the "Corpus Hippocraticum" or "Hippocratic Collection".

There are more than one hundred books altogether. Hippocrates did not write all these. But it was Hippocrates who arranged for them to be written.

His teaching was simple and practical.

Instead of praying to the gods, he said, the true doctor studies his patient. "First the physician must examine the face of the patient," he said, "and see whether it is like the faces of healthy people, and especially whether it is like its usual self." The expression, the voice, the breathing and even the way the patient lay in bed were all important.

Then he suggested ways in which the doctor could find out the illness from which the patient suffered. This is called the DIAGNOSIS. There were different symptoms for each disease, he said. It was the doctor's job to test in various ways to find out what was wrong with the patient.

But that is not sufficient, said Hippocrates. The good doctor should also know what is likely to happen as the disease develops. This is called PROGNOSIS.

In order to help other doctors he told the story of his own cases. He first described the patient: the sex, the age and how strong he was. He gave his diagnosis. Then he wrote down what happened

MEDICINE

to the patient day by day. Sometimes he found out that his treatment was doing no good, so he changed it. Sometimes the patient died. He was quite prepared to admit this. He hoped that his experience would help another doctor with a similar case.

Hippocrates did not believe in drugs, except on rare occasions when absolutely necessary. He said that Nature was the best doctor and all the physician could do was to help her.

But he did believe in cleanliness, especially for the doctors. He even said they should keep their finger-nails short.

If it was necessary to operate the light was most important, said Hippocrates. "The operator, whether seated or standing, should be placed conveniently to the part being operated upon and to the light. Each of the two kinds of light, ordinary or artificial, may be used in two ways, direct or oblique."

He was just as interested in nursing as he was in medicine. He explained how to bath a patient, and how to bandage his wounds. He suggested a kind of tar as a disinfectant, and for more than two thousand years doctors accepted his advice.

His advice was not always medical. Once he said: "Never put a layman in charge of anything, otherwise if a mischance occur the blame will fall on you."

Hippocrates turned Medicine from a mystery into a science. And he gave the physician pride in his calling. This is summed up in the famous Hippocratic Oath, which every medical student knows. It is too long to include here in full, but the spirit of the oath is shown by these two sentences:

"I will use treatment to help the sick according to my ability and judgment, but never with a view to injury and wrong-doing. . . . I will keep pure and holy both my life and my art."

When Hippocrates died the art of Medicine withered in Greece. He had disciples, but they were so anxious to do only the things that their master had done, that they tried nothing new. Gradually they lost their skill and confidence, and their patients suffered.

HIPPOCRATES, THE FATHER OF MEDICINE

But while the Greek civilisation was dying, a new civilisation came into being. The Romans, with their armies, their road-builders, their engineers, were building a great empire. Although their doctors were not very clever, the Romans have a large share in the history of Medicine.

From the small Italian town of Rome on the River Tiber, the Roman soldiers marched along their wide, straight roads across all the countries of Europe. They built camps to guard these roads, and in these camps lived soldiers with their families.

Disease was spread in these camps by poisoned water and GERM-laden MOSQUITOES. Although the Romans had no Hippocrates to give them advice, they tried to keep their soldiers healthy by matter-of-fact methods.

Each camp had its hospital and its medical orderlies. Water was tested, food examined. Sick men were kept away from the healthy soldiers. Trained men were too few for the Romans to want to lose them easily.

In this way the Romans have a share in the story of Medicine.

They taught us how to filter water and pipe it into our homes. They showed us how important it was to take SEWAGE away in deep drains. They began the science of public health.



Hippocrates: part of the statue's nose is missing

MEDICINE

While the army doctors knew little about the treatment of disease, they could set a broken limb and AMPUTATE a FESTERING one.

But the Romans never had much respect for the art of Medicine. No Roman freeman was allowed to act as a physician. Therefore Greeks and Egyptians trickled into the country to do the work, and some of them came only because they had failed in their own country.

Roman Medicine was inhuman. There were army surgeons because a soldier had to be fit to be any use. Sick slaves were treated because they also were valuable. There was even a law allowing the owners to put sick slaves in a temple of Æsculapius. If the slave died the owner did not have to pay for his grave. If the slave lived he could go free.

Although the Romans were cruel in some ways, they were clever, and it was bad for Europe when hordes of savages poured down the Roman roads and conquered the proud Romans. These wild Goths were more cruel and certainly more ignorant than the Romans. They had no love for Medicine. They smashed the Roman hospitals, drove the doctors out of the towns, and did their best to destroy the work of Hippocrates.

Europe had entered the Dark Ages.

CHAPTER THREE

Miracles and Magic

THE wisdom of the Greeks turned the art of healing into a science. The Romans brought hospitals and SANITATION to the countries they conquered. The Goths brought nothing but destruction. They lived roughly, fought cruelly and worshipped strange gods. They brought the Dark Ages of misery to Europe.

For more than a thousand years the art of Hippocrates was forgotten.

But the Dark Ages were not completely black. The Byzantine Empire preserved the important features of Greek and Roman life. There were many Christians. The religion of Christianity was a new way of living.

Jesus said: "I was sick and ye visited Me." He preached that love and service to one's neighbours was a Christian duty. Christians therefore believed that sick people should be treated tenderly. They believed that the doctors and nurses who cared for the sick were worthy of great respect.

Hippocrates would have understood this, but the pagans were too ignorant.

Even many people who believed in Christ did not fully understand his teaching. They heard of the miracles he performed, and they prayed for miracles to happen instead of doing their best to help the sick. Many believed that sickness was God's punishment for sin. So they treated all sick people as sinners and, instead of curing their ills, they asked them to confess their sins.

It was as if Hippocrates had never lived and people had returned to the sad old days of magic cures.

MEDICINE

For more than a thousand years after the birth of Christ, people who lived in the known world of Europe neglected the art of Medicine. They thought more of Magic than Medicine. They tried spells instead of diagnosis. They sought their cures at the witches' cauldrons.

The men who called themselves doctors prescribed strange medicines. Powdered skull, toad skins and cow dung were supposed to be good medicines. They thought that there was some magic even in the number seven. Medicines had to be stirred and boiled seven times. They were stronger if the mixing was done on the seventh day of the month and drunk on the seventh day of the week.

The gloom of the Dark Ages also settled on Surgery. For some reason, which they thought was Christian teaching, many countries refused to let doctors study anatomy. As surgeons, brought up to this rule, knew very little about the structure of the body, their operations were guess-work.

There was no ANÆSTHETIC to ease the pain or the shock. Doctors had long ago forgotten all that Hippocrates had taught about cleanliness during operations. Operations were performed clumsily, quickly and painfully. The wounds were treated afterwards with a painful LOTION of boiling oil and treacle.

Surgery was so despised in England that people thought that anyone who was handy with a knife or a pair of scissors could do it. Barbers often doubled the work with their own trade. They cut hair, trimmed beards and supplied wigs. But just as readily they sawed off a limb or cut away an ABSCESS.

There were so many barber-surgeons that at last they formed a Guild of Barber-Surgeons.

The barber's pole is a link with the Guild. The old barber-surgeon fastened it outside his shop to show that he was ready to perform operations. The pole is supposed to represent a limb. The white stripe painted round the pole represents the bandage.

MIRACLES AND MAGIC



The Barber-Surgeons receiving their Charter from King Henry VIII

The brass knob at the end stands for the bowl that caught the blood.

There was plenty of blood. If an operation was not needed the barber-surgeon nearly always suggested that the patient must be bled. It was the cure suggested for every disease. As men often had too much to eat and too much to drink in those days, it sometimes worked wonders. But many patients lost their lives because of the treatment rather than because of their disease.

There was however one medicinal art that flourished in the Dark Ages. This was the art of the HERBALIST.

The monks did most to preserve this art. Their monasteries and priories stood on the great roads along which the pilgrims passed. It was the Christian duty to tend the sick, and every monastery had at least one monk skilled in the art of Medicine. Perhaps he knew little about Surgery and had no desire to practise it. But there were few monasteries without their herb-gardens.

MEDICINE

Manor-houses often had herb-gardens too, and a still-room fragrant with the smell of drying herbs.

The APOTHECARIES in the towns collected the hedgerow flowers and brewed their medicines or queer POTIONS. Usually they remembered the mixture from their apprentice days, and they passed on their secrets by word of mouth before they died. But from the sixteenth century onwards a few English Herbals were published in which some of their secrets were printed, together with descriptions of herbs and other plants.

These were very beautiful books showing pictures of English flowers, describing them and explaining their use as medicine. The most famous of these was written by Nicholas Culpeper.

Perhaps there was one other reason why the art of the herbalist was not lost during the Dark Ages. These were the years of the poisoners. In many a dark street in Paris or in London were sly little shops where poisoners mixed their evil potions.

Although the works of Hippocrates were forgotten through these dark centuries, they were not lost altogether. Many of them were collecting the dust on the shelves of libraries in Constantinople.

This town was on the edge of the civilised world, and in the fifteenth century it was sacked by the Turks. The students fled, taking their treasured books with them. They reached safety in the European cities—Rome, Paris and London. And here men opened the great books and read again the wisdom of the Greeks and the Romans.

The printing-presses laboured to print enough copies for the students in the great cities to read. The wisdom of the Greeks was born again.

We call this great period of re-learning, the Renaissance. It was during these years that the art of Medicine began to flourish again.

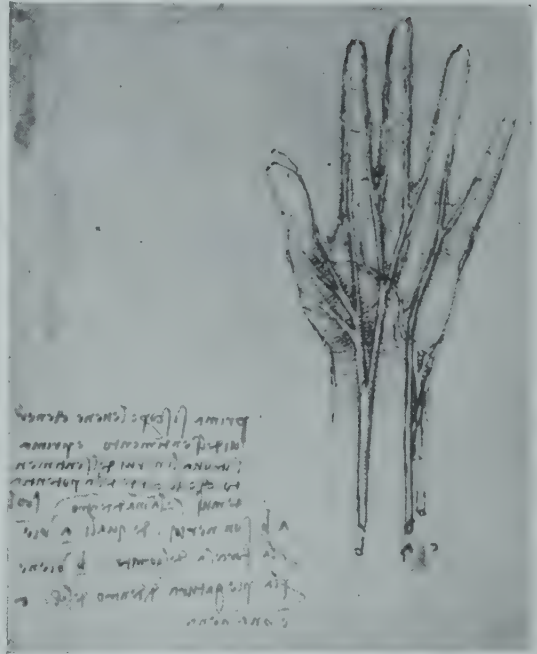
The greatest man of the Renaissance was Leonardo da Vinci. He was born just about five hundred years ago. He was both a

MIRACLES AND MAGIC

painter and a scientist, so when he drew pictures of the human body he tried to get them as exact as he could.

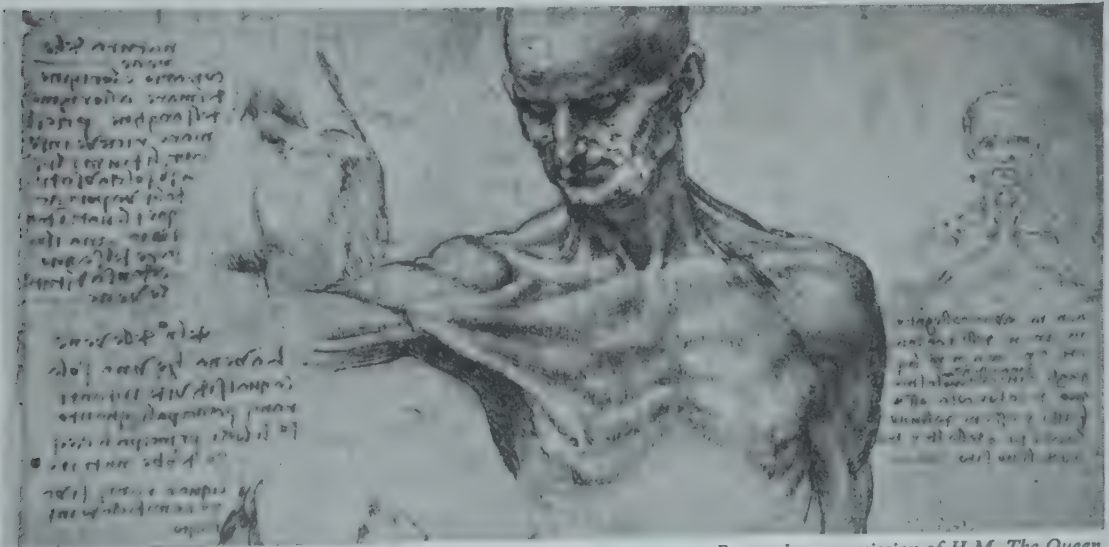
Every muscle was drawn. He showed plainly how our heads turned, our hands gripped, our feet kicked. It was his sketches that made many doctors wonder just how our bodies worked.

It was the work of men like Leonardo that roused men's curiosity. But they could not find out how the body worked unless they studied first how the body was made. This was the study of anatomy.



By gracious permission of H.M. The Queen

A sketch by Leonardo da Vinci showing the nerve supply of the hand



By gracious permission of H.M. The Queen

Some sketches and notes by Leonardo da Vinci

MEDICINE

The greatest Renaissance anatomist was Vesalius, who was born only five years before Leonardo died. French Universities did not allow DISSECTION, so this Belgian student, having spent some time in France, wandered on to Padua, a town in northern Italy not far from Venice.

For five years he studied the human body and then wrote down all he knew in one of the greatest medical books in the world. He described how the body was made as well as explaining how it worked. He wrote about the brain, the SPINAL CORD, the muscles, the heart, the LUNGS, the NERVES. There are many errors in the book, but it is so long and so full that it is surprising that there are not many more.

Vesalius, after achieving fame in Padua, suddenly disappeared. There is a legend that he made a mistake in anatomy; and when he found this out he was so worried that he went on a pilgrimage of penance to Palestine, and never came back.

When we use the word "bombast" we are using the Christian name of a famous doctor of the Renaissance period. Another of his names was Paracelsus. He was a bragging, boasting man who walked into his lecture-rooms flourishing a sword and declaring war on all the doctors who had lived before him.



*An illustration in the medical book
by Vesalius*

MIRACLES AND MAGIC

On one occasion he heaped all the medical text-books of Padua University and made a great bonfire of them. While the flames roared he told the wondering students that the only doctor whose words they should read was the great Hippocrates.

He may have acted strangely sometimes, but he was a clever doctor nevertheless, and brought Hippocrates' methods back into favour.

Even the Guild of the Barber-Surgeons felt the fresh wind of the new learning.

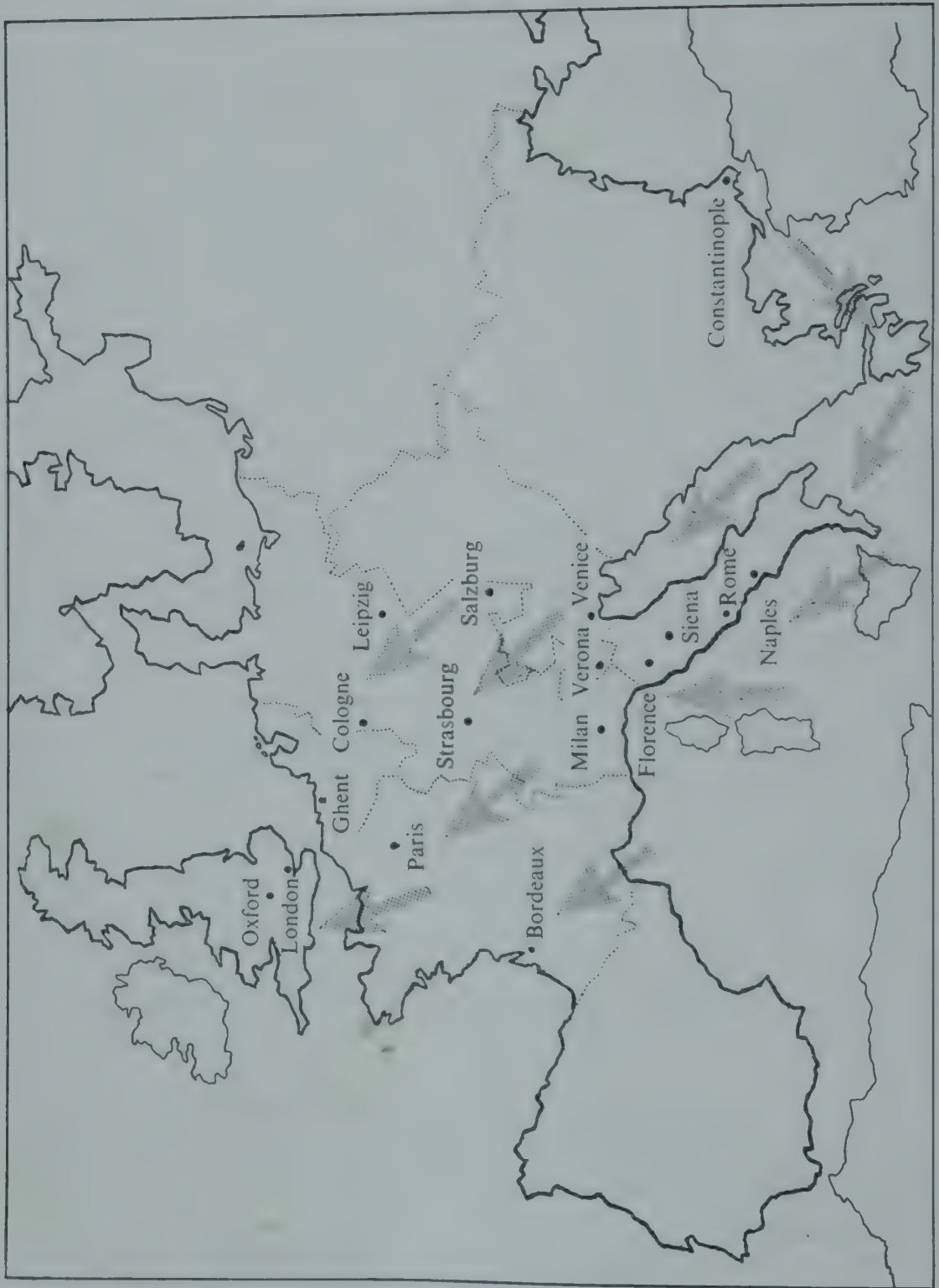
Ambrose Paré, a barber-surgeon in the French Army, showed that even army doctors, who had to operate in a rush, could use safer methods.

During the Battle of Turin in 1537, he ran out of boiling oil and treacle with which to treat the battle wounds. In desperation he tried a lotion of egg-yolk, oil of roses and turpentine. He was surprised the next morning to find that the wounds which had been treated with the turpentine were in a better condition than the ones which had been smeared with boiling treacle. Although he did not understand why this was so, he always used the new lotion afterwards. He did not realise that he had discovered a disinfectant that could save men's lives if it was used properly.

The Renaissance changed people's lives. But it did not come suddenly like a war. The effect was felt slowly. First the great teachers and doctors read the new printed books and lectured about them. Their learning spread to the lesser doctors, who worked in the hospitals and went into the homes of the people. Last of all, the new learning came into the lives of the common people.

Then at last people realised how much they had forgotten of the better ways of living. The Romans had built fine houses. They had made straight, wide roads. They had piped away the filth from the houses and the streets. They had built baths.

During the Dark Ages all that had been forgotten. Houses.



The Renaissance: how the new learning spread across Europe

MIRACLES AND MAGIC

streets and towns had been built higgledy-piggledy. The houses were huddled together, shutting in the narrow streets. The overhanging top storeys kept the sun out and the smells in.

And there were plenty of smells!

The waste from the houses was carried away by a single gutter that ran down the middle of the cobbled street.

People laid rushes and straw on the floors of their houses instead of carpets. When the floors became dirty, fresh straw was laid on top of the old. When the depth was too much for comfort and the smell too great to be ignored, the dirty straw was swept into the street.

Every summer when the smells in London were too great for sensitive noses, the Court moved out into the country, and all the people who could afford to do so went with them.

But the streets were still crowded, and the smells remained—and the flies, the rats, the dirt and the disease. Men believed that PUS was necessary for a wound to heal, so all wounds were left open to the air—and to the flies. Men ate maggoty meat because they knew no better. They drank any water wherever it came from and thought that flies and rats were merely a nuisance.

So throughout the summer, when the smells and the pests were at their worst, disease stalked through the streets of London; deadly diseases such as CHOLERA and TYPHUS fever; diseases which began in the drains.

The worst disease was called simply the PLAGUE. One outbreak, which was known for evermore as the Black Death, in 1348 killed half the people of London. It wiped out whole villages, and for many years afterwards the whole country suffered.

The plague visited London many times, and three hundred years later it killed one in every five Londoners. Still more would have died if it had not been for the Great Fire, which got rid of the INFECTION.

The doctors did not know what to do. They either ran away into

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London Plague Cart

the country or stopped and died with their patients. They did not even know the cause of the disease.

The plague germ—or BACILLUS—lives in the stomach of fleas, the fleas which live on rats. In 1665 London was almost as rat-ridden as the Pied-Piper's town of Hamelin. When summer came and people moved out of their town houses, the rats moved in, taking their fleas with the disease into the empty houses.

Some people thought that animals might spread the disease, but unfortunately they killed the dogs, thinking that they were the guilty ones.

Although they could do so little, some doctors did try to fight plague.

One of these valiant doctors was Nathaniel Hodges, who de-

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scribed how he spent his days during the plague. He rose early and took a dose of “*anti-pestilential electuary*”, a foul-tasting medicine, before spending several hours seeing crowds of patients in the hospital.

After breakfast he visited patients in the plague areas of the town. He carried his gold-knobbed cane stiffly before him. Sometimes he bent forwards and sniffed at the herbs which had been powdered and stuffed into the knob. He sucked sweets containing MYRRH, CINNAMON and ANGELICA ROOT.

He tried medicines recommended by the apothecary. He decided that BEZOAR STONE, unicorn’s horn and dried toad powder were no good. He preferred to starve his patients, giving them only SNAKE ROOT to make them sweat. He did try the “Plague Water” suggested by the College of Physicians, and decided that it was not very certain in its effect.

At the time of the Black Death there had been no doctors to think of their patients. The work of Dr. Nathaniel Hodges was one of the results of the Renaissance. It was the teaching of Hippocrates: the physician’s pride in his work.

But during the seventeenth century the first of the great doctors of our country began the great tradition of Medicine in Britain.

CHAPTER FOUR

Cavalier and Roundhead—The Story of Two Great Doctors

The Cavalier

ONE day, a little more than three hundred years ago, an important visitor called upon a young foreign nobleman who was staying for a short time in London. He was the personal physician to King Charles I, a small, alert, dark-featured man named Doctor William Harvey. The visitor came upon a strange errand.

Some years before, the young nobleman had had a serious accident. He had had three of his ribs removed from one side and his heart was exposed. Heavily bandaged, this young man lived a normal life.

After some conversation the doctor made a request. The young man agreed to do as the physician asked. His servant carefully unwrapped the bandages, and the great gap on one side of the chest was exposed. The heart itself could be seen beating away with no wall of skin and bone to protect it.

Doctor William Harvey dropped to his knees. He placed two fingers within the hole in the man's side and touched the heart. He knew that there is no sense of touch in the heart itself and that the young man would feel no pain.

Later the little doctor brought the young man to the King for him to observe the wonder.

"There, Your Majesty," he said, "that is the heart itself."

As the King stared in amazement, Harvey explained what was happening.

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*Harvey demonstrating the circulation of the blood to
King Charles I*

“The heart is always moving, Your Majesty. It is a pump, pumping blood round the body.”

The King smiled and nodded.

“Oh, yes, Doctor Harvey,” he said, “I have read your book, and although many disbelieve, I know that what you say is true.”

There were few men to believe Doctor Harvey when, in 1628, he published his great book explaining how the heart pumped the blood round the body. His ideas were too new. They challenged the old theories that were believed.

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The influence of the Renaissance was felt in Britain, but many people cherished the old beliefs. Medicine was tangled up with sorcery, magic, religion and witch-craft. There was no medical school in Britain. Most doctors had very little training and knew very little about medicine. Most of them were like Dr. Nathaniel Hodges; honest, courageous but ignorant. As the body was thought to be sacred, doctors were not encouraged to pry into its secrets. Very few doctors understood the way the body worked. Many doctors believed that the heart was a furnace to warm the blood. They did not realise that the blood moved round the body. They thought that the lungs had to keep the blood cool.

When we say that we are "in good spirits" we are using the words the old doctors used. They believed that though the blood remained still, it contained "vital" or "natural" spirits which moved through the blood.

It was fortunate that William Harvey had his medical training at Padua University. Here Vesalius had taught, and he had always said that doctors must study the body itself. Harvey's teacher, Fabricius, had the same view. He showed his students the mystery of the muscles, bones, arteries, veins, nerves and organs of the body. By the time Harvey returned as a doctor to London he knew as much about the body as any doctor in Europe. But he was not satisfied that his teachers were right about the work of the heart. Harvey was a keen student as well as a doctor. A sentence that Plato had written remained in his mind: "The heart is the fountain of the blood and sets it in motion."

Doctors in his day did not seem to believe that. They agreed that the heart acted like a furnace to keep the body warm, but they did not understand why there should be blood in our bodies at all.

In Padua Harvey had been taught that much illness came from bad blood or even too much blood. One of the main treatments for illness was bleeding. Sometimes the body would be drained of several pints of blood in a single day.

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Could a man afford to lose all that blood?

What was the real work of the heart and of the blood?

He watched the heart moving in fishes and in frogs. He examined the heart in birds and animals. Then he tried a human experiment.

He tied a string round a man's forearm. It was tight enough to stop the blood flowing through the VEINS but not through the ARTERIES. He felt the blood pulsing into the arm. The arm turned blue with blood that could not flow back. The veins above the string became empty.

This showed that the blood flowed from the heart through the arteries but did not return that way. But where did it go?

When a patient was bled he grew white and became faint. It was as if he could not afford to lose the blood. It might mean, thought Harvey, that a man had a certain quantity of blood in his body all the while; and yet the blood did not remain in one place. It moved. Yes, but how?

The favourite advice of his teachers was a single word—"observe". Harvey did this. He observed; he experimented; he studied; he thought.

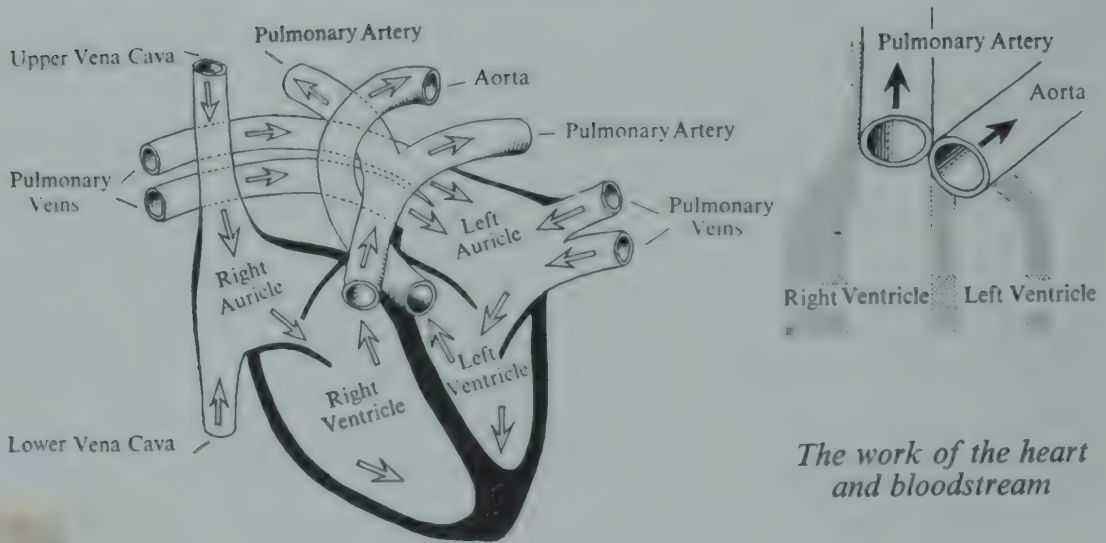
At last he knew.

Plato was only partly right. The heart set the blood moving. But it was the same blood. The heart was a pump not a fountain. The blood was pumped from the left side of the heart into the main artery—the AORTA. Then it flowed through the arteries to the veins. From the veins it flowed back through the body to the right side of the heart; then through the lungs to the left side of the heart once more. Then the whole process began again.

The blood did not remain still; it was pumped round the body. As it went round and round the body, it kept the body warm. No wonder patients who were bled grew pale, became tired, and sometimes died in a faint.

Harvey wrote down all he had found out. In 1628 his book called *De Motu Cordis* (About the Motion of the Heart) was published.

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*The work of the heart
and bloodstream*

At first the book came as a great shock. Some doctors shrugged their shoulders and went on with their BLOOD-LETTING. Others shook their heads and then read the book again. They tried to prove that Harvey was wrong, but all their experiments only proved how right he was.

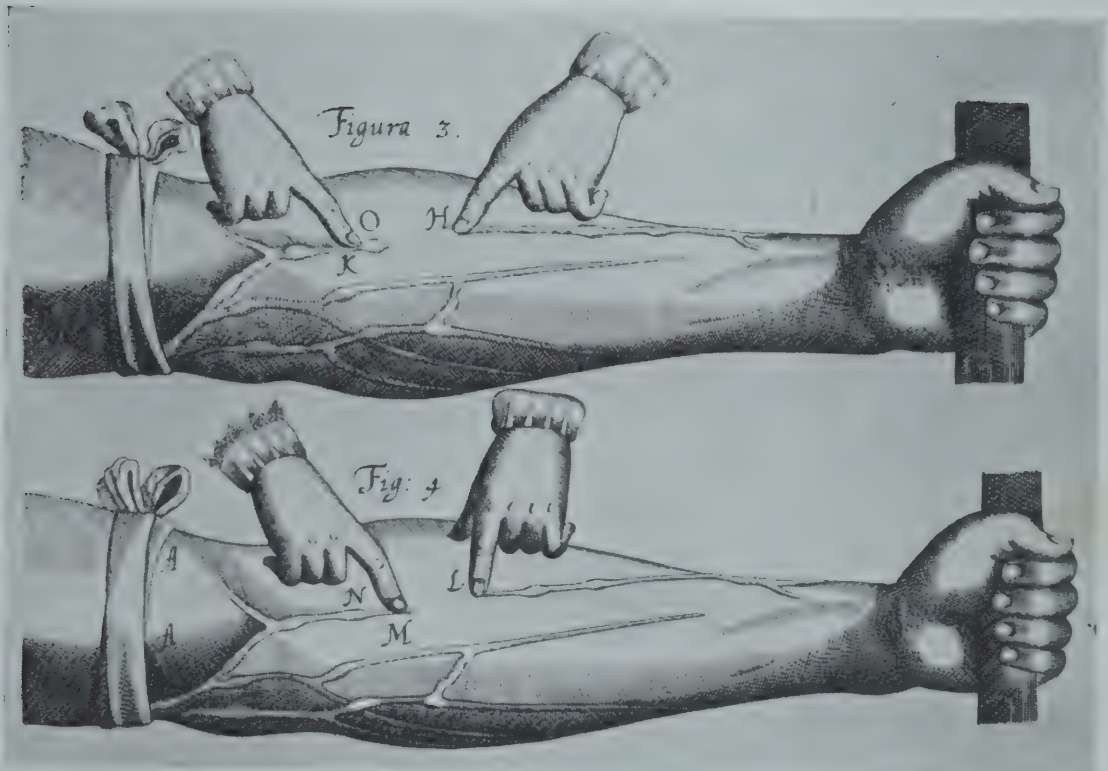
Very soon most doctors were prepared to believe Harvey's new ideas. Then they began to question other old beliefs.

He had shown men how to study the body and its work. The body did not work by magic; it was a scientific machine.

This is the great value of Harvey's work. He taught men to study the body as a science. Before Harvey's time the young nobleman with the exposed heart would have been regarded as a freak. Harvey treated him in the right way. In effect he said, "The body is a wonderful machine, let us learn all we can about it".

Harvey was the King's physician. He was more than that; he was the King's friend. During the Battle of Edgehill, he was asked to take care of the young princes. He took them out of harm's way, as he thought, behind a hedge. A misfired cannon-ball bounced towards them, and the young princes laughed as they saw their teacher scampering for safety.

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An illustration from Harvey's De Motu Cordis

The story of Medicine in Britain is mainly the story of great doctors. The first of these was William Harvey. He was the first British medical scientist.

There was one incident in Harvey's life which shows how advanced his views were, and how backward were the medical ideas of his day.

A boy fell asleep when he should have been working. To escape from punishment he told an untrue story about seven women, finally accusing them of being witches. These seven innocent old women were imprisoned and faced a trial. Doctor William Harvey, as the King's doctor, was asked to examine these old women to see if any of them had the Devil's mark. By the time he arrived three of the women had died of shock. Harvey soon set the others free.

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William Harvey was a royalist to the end. The death of his King was a sad blow to him, from which he never recovered. He died in 1657.

The Roundhead

The other great doctor of the seventeenth century was a Puritan. There is a story which gives a good idea of the man he was.

Some years after the Civil War when Thomas Sydenham the Puritan had already become famous, a young man was shown into his study. He handed the doctor a letter which said that he was "a ripe scholar, a good botanist, and a skilful anatomist".

"This is all very fine," said the great doctor, "but it won't do. Anatomy, botany—nonsense! Sir, I know an old woman in the flower market who understands botany better. As for anatomy, my butcher can DISSECT a joint as well. No, young man, all this is stuff! You must go to the bedside. It is there alone you can learn about disease."

Thomas Sydenham kept his own advice, and that is why he is famed today. He set the pattern for the good family doctor.

Like Hippocrates, Sydenham always studied his patients. He noted their flushes, the changes in TEMPERATURE, the way they sweated, the differing kinds of rashes.

He is sometimes called the "English Hippocrates", but while he acted very much like the great Greek physician, he made many wonderful discoveries of his own.

He was fortunate in following so closely upon the work of the King's physician. Harvey had turned men's thoughts towards medical science. The witches still brewed their horrible medicines and the apothecaries still sold their herbs and drugs. The barbers' poles still showed that bleeding took place every day in the little room behind the barber's shop. But the best doctors were beginning to study patients and diseases properly. Thomas Sydenham set a standard for them to follow.

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He said plainly that the doctor must know his patient. The treatment should differ according to the age and strength of the patient, and according to the disease from which he suffered.

That seems common sense to us now, but before Sydenham's time doctors frequently gave the same medicine to all their patients without even knowing or caring what complaint affected them.

Hippocrates said that a doctor must first observe. This was Harvey's first rule. But Sydenham carried the rule further than anyone. He sometimes did nothing except observe his patient for a number of visits. You can imagine how surprised and even annoyed the patient and

his friends became when Sydenham left them without saying what he thought or without giving them any medicine.

But Sydenham was only carrying out his principle that Nature was the best healer and no doctor could do more than help her to make the cure.

"It is my nature to think where others read," he said.

Some of his prescriptions were sensible rather than scientific.

To one patient, who had been bled and PURGED until he had no strength left, he said, "Give him a roast chicken and a pint of wine".



Thomas Sydenham

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He believed in fresh air. He ordered windows to be opened in sick-rooms. He told one man to get out riding across-country. The colour soon returned to the sick man's cheeks.

He was not ignorant of science, and used his knowledge whenever he thought there was a need. He ordered medicines containing iron for ANÆMIA, which is the correct treatment today. He was one of the first doctors to prescribe QUININE for MALARIA.

He had a contempt for charms and spells, but he knew the value of herbs.

"Take of cowslip flowers, one handful; boil them in enough black-cherry water to leave three fluid ounces, when strained off, to which add syrup of white poppies, half an ounce; juice of lemons, half a spoonful; mix the whole together."

This is a sensible herb brew today for the disease for which it was prescribed.

Sydenham believed that the signs of illness in a patient were not the disease. They were caused by the disease. He said that the pale face, the sweats, the uneasiness were all signs of a battle that was taking place between the strength of the patient and the attacking disease.

"A fever," he said, "was Nature's engine which she brings into the field to remove her enemy."

In common with all the doctors of his day he knew nothing of germ diseases, of BACTERIA and the deadly VIRUS. But he knew that diseases differed from each other, and he tried to set down plainly all he had discovered about the common ills of man.

He gave SCARLET FEVER its name and then described it. His description is a good example of the thoroughness of his observation.

"Though the Scarlet Fever may happen at any time, yet it generally comes at the close of summer, when it seizes whole families, but especially children. (1) A chillness and a



Doctor visiting an ill lady

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shivering come at the beginning; (2) afterwards the whole skin is covered with small red spots; (3) they continue for two to three days then scale off."

Throughout his life of sixty-six years Thomas Sydenham lived the steady earnest life of a devout Puritan. His home for more than thirty years was in London's Pall Mall, where he died in 1689.

These two doctors, William Harvey, who made the study of the body a science, and Thomas Sydenham, who was the first great GENERAL PRACTITIONER, changed the attitude of some doctors towards Medicine in the seventeenth century.

But there could be no great advance in medicine until man had beaten the great EPIDEMICS that threw their black shadow of fear over the lives of the people.

Thomas Sydenham studied the diseases that came again and again as epidemics, but he found that any REMEDY he could suggest was a failure. The epidemics defied man.

He wrote: "Cholera comes almost as constantly at the close of summer, and towards the beginning of autumn, as swallows in the beginning of spring, and cuckoos towards midsummer."

And there were epidemics more feared even than cholera!

CHAPTER FIVE

Edward Jenner, the Country Doctor

AT different seasons of the year the people in Britain suffered from epidemics.

The worst was BUBONIC FEVER, which was known as the plague. Fortunately the epidemics of plague were few and far between. There were only two great outbreaks between 1348 and 1665.

Cholera and typhus fever were more frequent, but they were not so widespread.

The epidemic that men feared most was SMALL-POX. Men could die of other diseases. But the sufferers who lived recovered completely. Few recovered from small-pox, and if they did they were marked for life with the scars of the disease. Half the people in Britain bore the dread mark of small-pox upon their flesh.

The country suffered from constant epidemics which swept the whole of the land. They usually started in the town's sewers. Then they travelled with merchandise and with patients seeking CONVALESCENCE in the country air, until by the middle years of the eighteenth century small-pox was a part of the pattern of life and death.

Chester provides a fair example of the effect of an epidemic. An outbreak occurred there in 1774. By the following year only fifteen people in every hundred had not had the disease. Nearly half the patients died.

With the Spotted Devil, as small-pox was called, claiming more than forty thousand victims every year it is not surprising that

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doctors were prepared to try all kinds of tricks to give people some chance of escaping the worst effects of the disease—death or blindness or disfigurement. But it was not a doctor but a traveller who brought the first real form of protection to Britain. Lady Mary Wortley Montague, who had travelled with her husband to Turkey, brought back the idea of “inoculation”. This is how she described it:

The Turks make parties for this purpose. An old woman comes with a nut-shell full of small-pox matter. She asks what vein you are pleased to have open. She immediately rips open the vein with a large needle and puts in as much venom as can lie upon the head of a needle, afterwards she binds up the little wound with a hollow bit of shell.

It shows how frightened people were, that this method of inoculation, which became known as “variolation”, swept the country. Unfortunately even the “best sort of small-pox” often proved fatal, and always caused some disfigurement.

It was also the best way of spreading the disease. At one time seventy-two people in every thousand died of small-pox. Now many more caught the disease. Eighty-nine people in every thousand died. More people sought the “cure”, and more people suffered its effect. What the end of it would have been no one knows because, fortunately, by the end of the eighteenth century the new principle of IMMUNITY, as it was called, had been discovered. The Spotted Devil was beaten at last!

This way of preventing small-pox was discovered through the observation, patience and work of one man, Doctor Edward Jenner, a country doctor who practised throughout his career in Gloucestershire.

Edward Jenner suffered from a “variolation” operation when he was seven years old, and he never forgot the horror of it. For six weeks he was prepared. He was bled and starved until he could

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hardly stand. Then he was inoculated. He suffered the full misery of the disease, which left its traces upon him. His own discovery saved countless boys and girls from suffering a similar experience.

He was born in 1749, the son of a country vicar. From very early days Nature study interested him more than Medicine. His medical training was typical of its period. After leaving school, he served as an apprentice to Dr. Ludlow of Sodbury near



Edward Jenner

Bristol. One day he heard a patient mention that as she had already had cow-pox she did not expect to suffer from small-pox. It was an idle remark, merely a country saying, but it stuck in Jenner's mind.

His apprenticeship served, Jenner went to London to complete his training. Here he had the good fortune to study under the great John Hunter. This famous surgeon had an interest in Nature Study. Jenner spent hours in Hunter's private zoo, and when he left London to return to Berkeley in Gloucestershire, he offered to send Nature specimens to Hunter.

Before long he was studying the habits of the cuckoo, and he wrote to his former master to tell him what he had learnt. Hunter encouraged him to write a report which was sent to the Royal Society. Every fact that Jenner stated has since been proved to be true, but the members of the Royal Society ridiculed the report. Jenner was not worried about this, for by this time he was interested in another study, and this was a matter of life or death.

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For some time he had been wondering if there was any truth in the country belief that an attack of cow-pox, a very mild illness, gave immunity from small-pox. He mentioned this to Hunter, and was told, "Don't guess. Make the experiment."

But that was easier said than done. Cow-pox was not very common, and no one was quite sure what the complaint was. Any countryman who suffered from spots on the hands said he had cow-pox. But it was not serious enough for him to go to a doctor.

Jenner saw every case that was brought to his notice. He made notes and saw what happened throughout the attack. He told his friend Edward Gardiner about this work one spring morning as they rode together from Gloucester to Bristol, and by the time they reached the port he had made one of the most important decisions in the history of Medicine.

One May morning in 1796 he took his nephew Stephen, who was an artist, to a farm where a dairymaid, Sarah Nelves, suffered from cow-pox. A sketch was made of the girl's hand, showing the PUSTULES, or pimples. This sketch was added to all his other notes. Then Jenner took some of the PUS from the pimples. The two men rode quickly to a neighbouring cottage, where a young boy, Jim Phipps, lived with his parents. The boy was ready for the doctor, who inoculated his arm with the cow-pox.

Jim Phipps suffered a little from loss of appetite and a headache. But nine days later he was perfectly well. Then came the vital operation. To test this method of stopping people from getting small-pox, Jenner had to see if James would get small-pox now. He therefore inoculated the boy with small-pox. If the boy did not get the disease, Jenner knew that the inoculation with cow-pox pus had beaten small-pox. Jenner made this entry in his diary: "I made several slight punctures in both his arms, and inserted the small-pox SERUM." Then came four triumphant words: "... but no disease followed."

Jenner wrote a full account of all that he had done. The book was

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Jenner vaccinating James Phipps

ignored. It was galling; here was the chance for thousands upon thousands of people to be saved from the Spotted Devil, and no one seemed to care. He went to London, only to find that people laughed at the country doctor who thought he had a cure for a disease that baffled the best brains in the land.

Then chance took a hand, When he left London he gave some of his despised cow-pox pus to Mr. Cline, a surgeon in St. Thomas's Hospital. The pus was injected into a boy almost by accident. Later the boy was given a

small-pox inoculation. Mr. Cline was amazed to find out that the inoculation had no effect. He used the cow-pox pus again and again, and followed the injection with small-pox. Then he was convinced that his country friend was right. The "vaccination" prevented small-pox. If a person had the germs of a less important disease put into his blood, the good germs fought them and became stronger. Then they were able to fight and beat the germs of the terrible disease when it attacked the body. But this was only possible with some diseases. A person inoculated with cow-pox germs did not get small-pox.

Soon all London was talking about Jenner's work. Some said that if people were VACCINATED they would turn into cows. But as more and more people had the operation Jenner's fame grew. He was called back to London, and spent a few miserable months there.

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He wanted to get back to his country lanes. He wrote: "Shall I hold myself up as an object for fortune and for fame? As for fame, what is it? A gilded butt, for ever pierced with the arrows of evil." He longed for his Gloucestershire hills. He would rather play his violin or write his poems or meet his friends at the "Fleece Inn", than be the guest of honour at a London banquet.

Vaccination spread with success throughout the whole world. President Jefferson was the first American to be vaccinated. The Empress of Russia gave a State pension to the first Russian child to be vaccinated, and gave him his Christian name—Vaccinov! The Spanish King fitted out a special ship to take vaccination to all the Spanish colonies. When at his Government's request, Jenner asked for the release of some soldiers taken prisoner in the wars against the Emperor, Napoleon said: "Jenner, eh! Ah, we can refuse nothing to that man!" The prisoners were set free. Parliament voted the country doctor £30,000, and the King and Queen of England appointed him Physician Extraordinary to their Majesties.

In Jenner's lifetime the scourge of small-pox was driven from the land. Louis Pasteur was later to work out the principle of immunity from it. An inoculation of a very mild disease can prevent an attack of a serious one. This principle is used to prevent ANTHRAX, HYDROPHOBIA and DIPHTHERIA.

Some people believed that inoculation could be used to prevent all the serious diseases. But we have found that it is not so. We still have some plagues: the common cold, for example. Inoculation can be used only for a few diseases, but before Jenner's time these were some of the worst ills in the world.

Perhaps, more than anything else, Jenner's main work was the change of mind he brought towards Medicine. Doctors began to think how to prevent illness rather than just how to cure it. The matter-of-fact way he set about finding the cause of the disease, his methods of observation and experiment, impressed his brother

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doctors, and they copied him. His work made the break with centuries of magic and QUACKERY. Harvey had shown the way to research; Sydenham had shown doctors how to go to work; Jenner inspired the hope of success in the eternal battle against disease. If the Spotted Devil could be beaten, so could other diseases.

CHAPTER SIX

The Conquest of Pain

WHILE Jenner was showing the way to conquer epidemics, the doctors in the hospitals were trying to improve surgery.

But first there was the problem of pain.

Today ropes can be seen dangling from one of the ceilings in a great London Hospital. They are disused today, but a hundred years or so ago they served a grim purpose.

These were the ropes that rung the bells to summon extra help to the operation rooms.

This was only one of the methods which surgeons used so that they could operate without too much trouble from the patient. Sometimes a doctor made the patient drunk. Perhaps a strong doctor would suddenly strike the patient to make him unconscious.

Directly the patient had lost consciousness, ropes would secure him to the table. Then the surgeon would whip out his knives and saws, and rush through the operation.

It was all done with the kindest of intentions.

The surgeon knew that the operation was necessary. He also knew that it would be painful. If he could manage to perform the operation before the patient regained consciousness, so much the better.

If he failed and the patient knew what was happening, so much the worse for both of them.

None of us likes operations. But we know that we will suffer no pain while the surgeon is performing the operation. We are given an anæsthetic to send us to sleep during the operation.

THE CONQUEST OF PAIN

Anæsthetics had been used before the eighteenth century. Primitive man probably knew more about them than the eighteenth-century surgeons. But when Medicine and Religion became a little confused, there were people who thought it was wrong to use anæsthetics. So gradually they were forgotten.

Sometimes pain is a good thing. If we did not suffer toothache we might never know that our teeth needed attention. If we did not suffer from burning we might not know that our foot was resting against a red-hot poker.

But it is no advantage to have pain during an operation. The dentist can tell which tooth needs taking out, and he would prefer us to be still while he is performing the operation.

An American dentist named Horace Wells thought about this a little more than one hundred years ago. One evening he went with some friends to a lecture on LAUGHING GAS. The lecturer had hired a dozen strong men to sit in the front row. These men were posted there to stop anybody who sniffed the gas from doing silly things.

The dentist's friend was one of the volunteers to go on the platform. The gas made him laugh, and then he attacked one of the strong men—who ran away!

A little later when he had recovered, the dentist's friend discovered that he had received a bad gash in his leg. While he was under the influence of the gas he had not noticed the accident.

Horace Wells thought about this. He found out that Dr. Joseph Priestley had first discovered the gas, and that Sir Humphry Davy had suggested that it might be used to kill pain during operations.

The dentist thought he would experiment with the gas. He did not realise that nitrous oxide, which is the chemical name for laughing gas, has to be used very carefully. He gave a demonstration. The patient woke up screaming in the middle of the operation. The people who had been invited to the demonstration were not very impressed.



First public demonstration of Surgical Anæsthesia in use

Horace Wells was never very successful with the gas, but he had a junior partner named William Morton, who had more patience, and more success.

After some experiments with laughing gas, Morton accepted the advice of a chemist friend and used a liquid called ETHER. The success of the experiments he tried on himself, his dog and finally his patients, convinced him that this liquid could be used in major operations.

With considerable courage he offered his services as an anæsthetist. Dr. Warren, the chief surgeon of the Massachusetts General Hospital, accepted the offer.

The demonstration took place before witnesses at the hospital on October 16th 1846. It is an important date in the history of Medicine.

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The time came for the operation. The witnesses waited eagerly. The patient lay ready on the operating-table. Dr. Warren stood expressionless beside him. William Morton had not arrived.

Dr. Warren took up the knife.

"As Dr. Morton has not arrived, we can only presume that he is otherwise engaged," said the doctor, and he prepared to go on with the operation.

At that moment Morton entered the room.

Dr. Warren wasted no time. He pointed to the man strapped on the table.

"Dr. Morton," he said, "your patient is ready."

Morton turned on the tap of his apparatus. There was a faint hiss and nothing more. The patient lay perfectly still.

"Dr. Warren, *your* patient is ready," said the anæsthetist calmly.

The operation was conducted without any fuss or trouble. The patient breathed easily and gently, and gave no sign that he suffered pain.

When it was all over Dr. Warren laid down the knife. He turned to the silent witnesses.

"Gentlemen," he said, deeply moved, "this is no humbug."

The American Congress decided to celebrate the wonderful discovery of an anæsthetic by granting an award of 100,000 dollars to the man who first thought of it.

There were many people who thought that William Morton deserved the prize. Others put forward the claim of the unfortunate Horace Wells. In Britain men said that Dr. Priestley or Sir Humphry Davy should have had the prize. Then it was discovered that a Dr. Hickman, of Ludlow in Shropshire, had used ether and said how valuable it was years before. An American doctor named Crawford Long proved that he had used it in his surgery.

In the end, the Congress decided not to make any award at all. Perhaps that was the fairest thing to do.

Very few discoveries are made by one man alone. People worry

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about a problem for a long time, and then several people find out the answer at about the same time.

Oliver Wendell Holmes, who wrote humorous books, suggested the name anæsthesia. He also suggested that a memorial should be made and named "To E(i)ther"!

Ether unfortunately had an unpleasant smell, and this aroused the anxiety of the patients even before they fell asleep.

Dr. Simpson of Edinburgh discovered another liquid which had the same effect without the same unpleasant smell. He experimented upon himself and friends, and when one evening he woke to find himself on the floor with his two friends, he decided that CHLOROFORM was a good anæsthetic to use.

Chloroform was used for a long time. But ether is used more now that we have discovered how to take the unpleasant smell from it.



The night on which the anæsthetic effect of Chloroform was discovered

THE CONQUEST OF PAIN

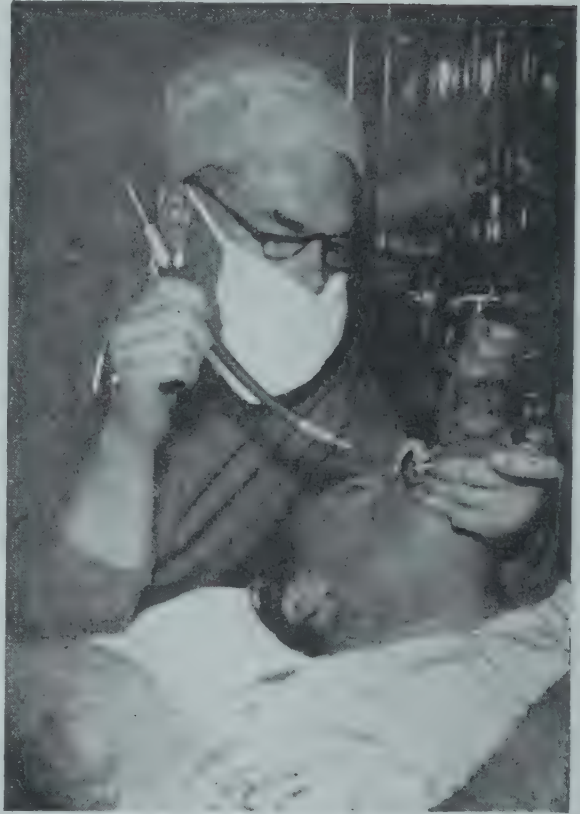
Dentists sometimes use a local anæsthetic. The patient does not lose consciousness, but there is no pain while the tooth is being taken out. The original local anæsthetic called COCAINE was discovered about eighty years ago by an Austrian.

Local anæsthetics are sometimes preferred to general ones in eye, nose, and mouth operations as the patient can assist the surgeon.

The discovery of anæsthetics has meant far more than a painless operation for the patient. While the patient suffered the surgeon could not perform a difficult operation. He had the single aim of finishing the operation as quickly as possible. With the patient unconscious the surgeon was able to take more time and he was able to consider better ways of performing the operation. He could do operations that formerly would not have been possible.

Once anæsthetics came into general use the surgeon's work improved. More attention was given to instruments. Surgeons were even able to explain what they were doing while the operation was going on.

The bells in the old hospitals that were used to summon extra help for the operation rooms have gone rusty with disuse. The ropes are still there, but no one pulls them now. It is just as well that it should be so.



Modern anæsthetist at work

CHAPTER SEVEN

Florence Nightingale and the Reform of Nursing

IN one of his books, Charles Dickens, a famous author who was born more than a hundred years ago, described two nurses.

One of these was Sairey Gamp, the visiting nurse. And a very unpleasant, ignorant, greedy, thieving and cold-hearted person she was too! She dragged the pillows from a patient's bed to add to her own comfort. She ate the special food prepared for her patient. Then, comfortable in her easy-chair, and indifferent to the welfare of her patient, she drank herself into a drunken slumber.

Betsy Prig, the other nurse, worked in the famous London hospital known to most Londoners as Barts, although its real name was St. Bartholomew's. She was as cruel, as greedy and as ignorant as Sairey. When the two women met they usually exchanged stories of how they had tricked their patients and the doctors.

Sairey and Betsy had never passed an examination. It was possible that they had never been to school. They had little or no knowledge of medicine. They had no thought for their patients except what they could make out of them.

But in the early years of the nineteenth century nearly all nurses were like this.

"The nurses are all drunkards, sisters and all," said one London doctor, "and there are but two nurses whom the surgeons can trust to give the patients their medicine."

This was the "Dark Period" in British nursing. Doctors were

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struggling earnestly towards the great discoveries in medicine in the middle of the century. Sometimes their treatment was at fault, but even when their diagnosis was correct and the treatment good, their patients died because of the treatment given to them by the nurses.

Nurses had very little pay. Their only home was the hospital itself. They lived in the ward in which they nursed the sick, cleaned the floors, cooked and ate their meals. They were often drunk and always dirty.

The hospitals were as bad as the nurses. They were foul, gloomy places with a very unpleasant smell known as "Hospital Smell". They were always crowded. Wide beds were packed into bare, barn-like wards. More than one patient was crammed into a single bed. It did not matter whether they suffered from PNEUMONIA or a broken leg, or even from one of the infectious diseases—MEASLES, MUMPS or FEVERS—they were all squeezed into the same bed.

Dirty linen was rarely changed, and when it was finally taken off it was thrust into crates under the bed until the nurses could find time to wash it. The ward was heated by open fires, which often smoked and set the patients coughing. When this happened no one opened the windows. Fresh air was dangerous to sick people, it was said! Some hospitals even had their windows boarded up for the winter.

Then quite suddenly, in less than twenty years, all this was changed. It was a revolution; a revolution in hospital treatment, in hospital conditions and most of all in the whole system of nursing.

This revolution was almost entirely due to the wonderful work of one woman—Miss Florence Nightingale.

Perhaps even Florence Nightingale could not have done all she did if it had not been for a war.

This war was fought in the Crimea. Russia sent an army over the Turkish border. The Turks asked their friends, Britain and France, to come to their aid. Suddenly Britain, with very few people knowing what it was all about, was at war.

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Britain's last war had been fought against the French. It had finished in victory at the Battle of Waterloo.

The Crimean War was a different kind of war; how different the army generals were soon to find out. All the soldiers and supplies had to be taken many hundreds of miles by ship. And very few people knew anything about the Crimea, where the war had to be fought. Was it a hot country or a cold? Was it mountainous or flat?

The army's housekeeping broke down. The whole system was out of date. The needs of the army and the great distances to be travelled were too great. The soldiers were sent out in their summer kit, and were soon shivering in the bleak winds of a terrible

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Crimean winter. There were men without boots, guns without ammunition and horses without fodder.

The system that was perfectly satisfactory in Britain failed completely in a foreign land. There were plenty of boots, thousands of boxes of ammunition and bales of hay. But the men in charge would not release the goods without permission. And the men who could give permission were hundreds of miles away in London.

Disease became a worse enemy than the Russians. There were more sick than wounded.

Forts and barracks were converted into hospitals to take the sick men. These places were inconvenient and INSANITARY. The CESS-PITS for rubbish were often underneath the hospitals themselves. The windows were mere slits. There were few beds. Most of the men were laid on the bare floors. They lay within arm's reach of each other.

There were less than half a dozen qualified doctors. The only nurses were a few soldiers considered to be unfit for full military service. They did what they could, but they knew nothing about nursing.

Among the troops was a civilian, the first War Correspondent. He was an indignant witness of the soldiers' suffering. This was William Howard Russell of *The Times*.

He made notes furiously. Then he sent his angry despatches home to England to be printed in *The Times*.

"It is with feelings of surprise and anger that the public will learn that no sufficient preparations have been made for the care of the wounded," he wrote. "There are not sufficient surgeons . . . no dressers . . . no nurses . . . not even linen to make bandages."

The readers of *The Times* expected to hear of glorious victories. They were horrified when they read of nothing but muddle and disease and death. They grew as indignant as Russell and clamoured for something to be done.

One of these readers was the very man who could do something about it. This was Mr. Sidney Herbert, the Secretary at War.

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Within a couple of days he had made up his mind what to do to save the situation. He wrote a letter to his friend, Florence Nightingale, asking her to go to the Crimea to reorganise the nursing arrangements.

The letter crossed with one from Florence Nightingale volunteering to do the work he wanted.

There could have been no woman in Britain better suited to do the work. At this time she was thirty-four years of age. She came of a wealthy family. Her mother loved playing the hostess and was fond of travelling abroad. It was while they were in Florence in Italy that her daughter was born and named after the town.

Florence Nightingale was not pretty, but she had a pleasing manner and a charming voice. She also had a strong will. She hated the thought of living the idle life that so many of her rich girl friends were forced to lead.

Convinced that she had some future work to do, she was at a loss for some years as to what that work should be. Then at last she knew that she wanted to be a nurse.

Her parents were distressed and angry. They bluntly refused permission. Florence Nightingale bided her time. At last the opportunity came for her to visit a famous German hospital where nurses learned to do their work. Here, at the Kaiserworth Hospital, she taught herself to do the work of a trained nurse.

She defied the wishes of her parents and became the matron of a Harley Street hospital. It was very small and very genteel, and nothing like her future work, but here she served her apprenticeship. She persuaded her friends to give her books about nursing, medicine, HYGIENE, SANITATION and even hospital plumbing. By the time the Crimean War began she was a well read woman who knew hospital work from every angle.

Some women shuddered at the thought of battle and disease. But not Florence Nightingale! She was not a tender woman by any means. The only time she cried was when a pet died.



Florence Nightingale (a photograph taken in 1858)



*Florence Nightingale in the Barrack Hospital,
Scutari*

She had no romantic ideas about nursing the poor wounded soldiers. When one of her young nurses said how eager she was to nurse the wounded, Miss Nightingale said grimly: "The strongest will be wanted at the wash-tub."

She was thorough and matter of fact. Her thirty-eight nurses spent more time cleaning and scrubbing, washing foul clothes, making bandages, than they spent serving medicine or sitting at the bedside of the soldiers. At first the nurses had only one copper bowl for washing themselves and for their meals.

The doctors showed that they resented their presence. Florence Nightingale could be critical, but she could also be tactful. She gave orders that the nurses must obey the doctors. The doctors soon found them useful, and were only too glad to have their help. They respected the nurses and respected Florence Nightingale.

The soldiers loved her. They saw the changes she made in their

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conditions. They saw how hard she worked with her nurses to make them more comfortable.

Every night when the day's work was done and there was only the dim flicker of a candle light in the uneasy wards, Florence Nightingale went upon her evening inspection. She walked four miles every night. She noticed beds that had to be moved, sheets that had to be changed, soldiers who needed more help.

The sick men, uneasy with pain, waited for her coming. A lamp



A modern nurse giving a patient his medicine

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showed a glimmer at the end of the ward. There was the swish of her dress as she passed, and perhaps a whispered kindly good night.

Then, long past midnight, she settled again in her room and prepared to write the long reports to Mr. Herbert. These letters were full of details. There were suggestions for improvements. There were demands for more equipment.

Those letters travelled home to England in the soldiers' mail-bags. And in more mail-bags were many letters from the soldiers that told of Florence Nightingale and described the wonderful work she was doing. The soldiers called her "The Lady with the Lamp".

The relatives of the soldiers began to talk of showing their thanks for her work. They opened a Nightingale Fund.

Florence Nightingale had all the money she wanted for herself.

In fact, she had already spent a great deal of her money for the good of her work. She wanted the Fund money to be spent on hospital work.

She returned, broken in health, when the war was over. She knew then full well how she would spend the money; it should pay for a nursing school so that nurses could be properly trained.

The Nightingale School for nurses was begun in St. Thomas's Hospital in London. The first students were fifteen girls taught by a Superintendent, Mrs. Wardroper.

The training was very strict



A room in a nurses' hostel today

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and very thorough. Their training lasted for a year, during which time these young nurses received a wage from the fund. That school and those fifteen young girls were the beginning of the modern system for training nurses.

By the time Florence Nightingale died in 1910, nursing had become a profession to which any woman was proud to belong. Nurses were properly trained, and they were respected by all classes of people, especially by the doctors.

CHAPTER EIGHT

Pasteur and the Little Beasties

It was van Leeuwenhoek, a Dutch draper, who first called MICROBES the “little beasties”. And he was one of the first men in the world ever to see them. He made one of the first MICROSCOPES. Any tiny speck placed on the glass slide beneath his LENS was magnified many times.

He scraped the TARTAR from his teeth and looked at that through the lens. He was amused to see tiny living creatures moving across the slide.

Van Leeuwenhoek would not have been so amused if he had known that some of these microbes were the enemies of his teeth.

The history of Medicine is the long story of the battle against disease. And yet until van Leeuwenhoek looked through his microscope at the little beasties, Man had not even seen the enemy. Even then, Man did not understand how great a villain the little beastie was.

Doctors once thought that men became sick because of devils and witches. Meanwhile the true enemies



Leeuwenhoek's microscope

PASTEUR AND THE LITTLE BEASTIES

escaped blame because they were too small to be seen with the naked eye.

Even when van Leeuwenhoek invented his microscope and the microbes could be seen, their importance was not understood. The draper was made a member of the Royal Society in 1680, but it was two hundred years later before the importance of his little beasts was realised.

May 5th 1881 is an important date in the story of Medicine.

On that day very strange things happened at the farm of Pouilly le Fort near Paris in France. In a large barn a number of animals had been collected, a queer mixture of sheep, goats, and cows. And they were protesting as animals do in such circumstances.

A little distance away four men stood beside a small table on which lay bottles and test-tubes, each stoppered and containing some clear liquid. A crowd of witnesses stood behind barriers watching curiously.

The reputation of two men and the whole future of Medicine depended upon the experiment that was about to take place.

One of these men was the short, stocky man who was treated with much respect by the other men round the table. This was Louis Pasteur. At one time he had been a chemist who was interested in the FERMENTATION of wine.

Pasteur lived in the wine country, and the well-being of his



A modern microscope

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neighbours depended on the quality of wine. They had asked the clever chemist to help them. He had studied the fermentation of the wine until he could tell them when the wine was fermenting as it should or when it was just going bad.

Van Leeuwenhoek would have stared if he could have seen the men and girls with microscopes studying the wine in the vats, and deciding which of his little beasties were friends and which were enemies.

But the experiment in the barn was much more important than Pasteur's experiments with the wine.

A few months before Louis Pasteur had given an important lecture. He had talked about the little beasties. He said that these microbes were everywhere to be found. They were in our bodies. They were in the bodies of animals and birds. They were in our food. They were in the water we drank. They were in the air we breathed.

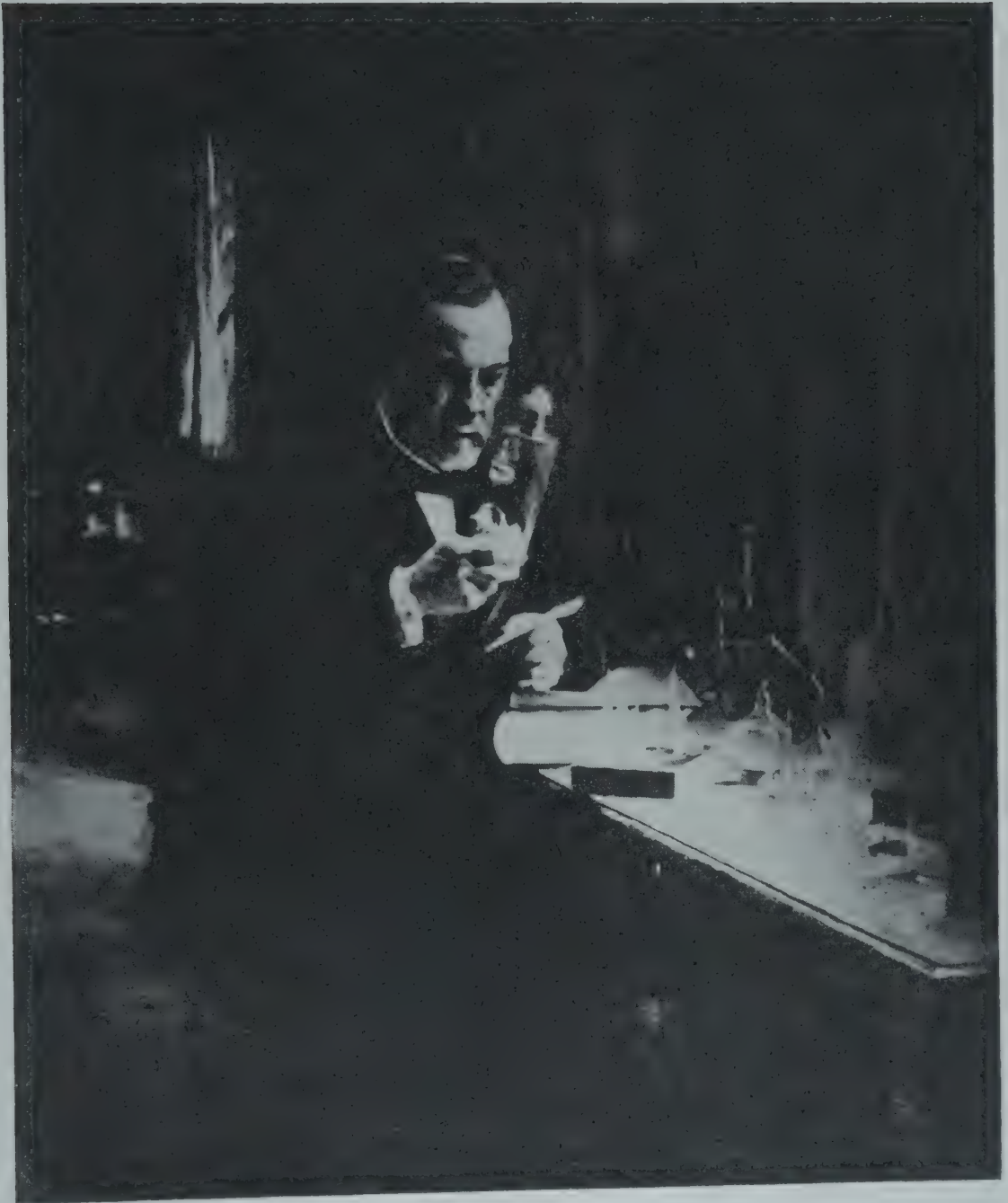
Many of them did not matter, but some of them were very dangerous. They were the messengers of disease. Often the friendly microbes in the body fought them and they were beaten away. But if they won and stayed, the person who held them in his body died.

There was a way to beat them. This was Jenner's way, said Louis Pasteur, and he used Jenner's word—"vaccination".

Then he used another word: IMMUNITY. He said that it should be possible to make vaccines for each disease. If these could be injected into an animal's body, that animal would be safe from the disease for the rest of its life.

He said: "Nothing could be easier than to give immunity to sheep, cows and horses from the deadly diseases from which they suffer."

There were many people in France who thought that this was all wrong. They challenged Louis Pasteur to prove that he was right. Pasteur had accepted the challenge. The disease he meant to conquer was anthrax.



Louis Pasteur

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Anthrax was one of the worst animal diseases in France at that time. Beasts that seemed quite healthy suddenly grew ill with the disease, and after they died all the flock or herd followed them to the grave.

It was such a mysterious disease that farmers usually said that the animals who suffered from the sickness must have been grazing on a witch's field.

Long before the challenge and the great experiment, Pasteur had been trying to help the farmers to beat this terrible disease. He was certain that the little beasties of anthrax were the trouble.

He soon checked this and found that he was right. But it was one thing to find the anthrax germs and quite another to kill them.

He tried spilling anthrax germs on the hay which was eaten by the sheep. Some sheep died, and some did not. But when he mixed sharp straws and thistles with the soft hay, all the sheep suffered from anthrax. Pasteur decided that the sharp bristles had cut the sheep's mouths and that let the anthrax germs get to the blood stream.

Pasteur advised farmers not to give their flocks rough hay.

Then Pasteur discovered that when flocks died from the disease they were buried in shallow graves in the fields. He saw one of these graveyards long after the dead sheep had been buried. He saw that it was covered with worm-casts. Perhaps, he thought rightly, the anthrax germs remained in the worm casts to be nibbled by the healthy sheep cropping the grass.

So he advised farmers to bury sheep right away from the grazing fields.

But Pasteur was still not satisfied. He wanted to wipe out the disease altogether. He went on experimenting.

He worked with his assistants in a laboratory. They collected microbes as a boy collects caterpillars. But as they were so very tiny it was necessary to take more care of them. The anthrax microbes were fed on soup. They were sometimes injected into small animals and the effects observed.

PASTEUR AND THE LITTLE BEASTIES



Pasteur with his microscope

One day a small dish containing microbes in their soup, called a CULTURE, was lost. When it was found again it was old and bad. Nevertheless, it was used to inoculate some chickens. The chickens sickened but recovered.

A lesser man might have thought nothing of this. Pasteur decided that here was the clue he needed. If he could weaken the cultures and then inoculate animals or birds or even humans with them, it would be possible for the creature to have a small dose of the illness, recover and then be protected from attacks from that illness.

It was the same principle that Jenner had already discovered to vaccinate people against small-pox. But Pasteur was learning how vaccination worked, and when that was understood people could be inoculated against other illnesses besides small-pox.

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But at present the battle was against anthrax. Pasteur continued his experiments until he felt that he was ready. He could strengthen and weaken anthrax germs as he wished.

It was at this moment that Pasteur gave his famous lecture declaring that immunity could be given to animals against diseases.

The challenge from the editor of a famous paper followed. He said that Pasteur should prove it—if he could. Pasteur accepted the challenge.

Now on May 5th the men who wished to prove Pasteur wrong began to prepare the animals for the first inoculation. They punched the ears of the animals which were going to be vaccinated. The others they left unpunched.

His enemies did everything to make it difficult for him. They even changed the animals at the last moment so that he was inoculating cows and oxen and goats as well as sheep. Pasteur took it all very calmly. Without any bustle or fuss he carefully inoculated the animals with punched ears and left the others alone.

When it was finished all the witnesses went into the farm to listen to a lecture by Pasteur on immunity.

On May 17th the same people collected at the farm again to witness a second inoculation with a slightly stronger dose of the vaccine. Then on the last day of the month all the animals, whether they were marked or not, unvaccinated and vaccinated, were given a strong dose of anthrax.

As the inoculation was about to take place one suspicious little man ran up to Pasteur and gave the bottle of germs a vigorous shake.

“Ah, I know the trick,” he said, “the weak fluid at the top would be injected into the vaccinated animals. The unmarked animals would get the strong doses. I know!”

Pasteur smiled and gave the bottle yet another shake.

When the inoculation was over everyone went home knowing that now all that remained to be seen was which animals died.

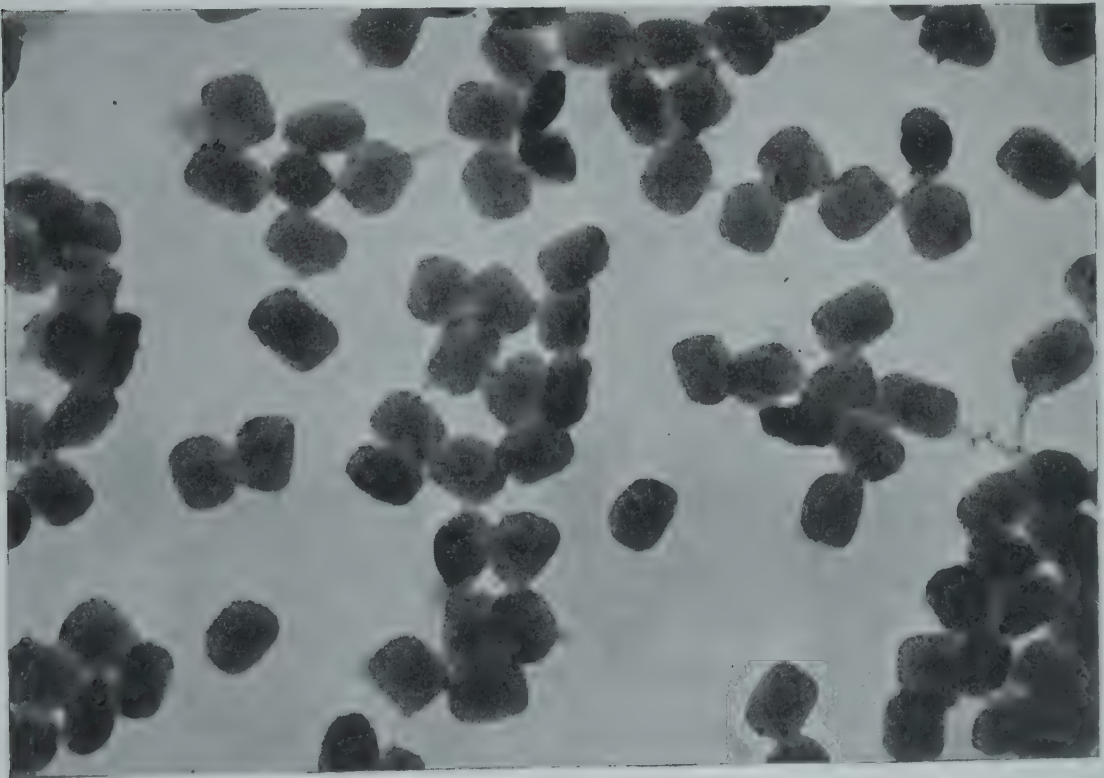
PASTEUR AND THE LITTLE BEASTIES

It must have been a very worrying time for Pasteur. He had declared that this test would prove that he was right. Animals could be given protection against diseases. And if animals could be given protection—or immunity—so could people. But if the test failed people would laugh at him, and at his method of protection.

Then, twenty-four hours before he was due to go to the farm to see the result of the experiment, he had news that one of the vaccinated sheep was dying.

Many men would have despaired. But Pasteur had such faith in the experiment that he declared that the sheep must be dying of some other illness.

On June 2nd the same crowd of people arrived at the farm. There was no need for a referee to decide whether Pasteur or the editor



Cowpox germs magnified nearly 40,000 times by an electron microscope

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was right. All the animals who had not been treated were dead or dying. The other animals were moving happily across the grass, fine, healthy animals as they had been before the experiment had been begun. There was a single exception. One sheep was dead. But on examination it was seen that the animal had died of another sickness.

Pasteur and the principle of immunisation had been proved boldly and dramatically right, never to be disbelieved again.

It would be wrong to give all the credit of immunisation to Pasteur.

At that time France and Germany were enemies, and patriotic Frenchmen and Germans had nothing to do with each other. Otherwise possibly Pasteur would have known Robert Koch, and the two men might have experimented together, or at least have let each know what the other was doing.

Koch was only a country doctor at one time, but his clever work led to his appointment to an important post in Berlin. Here he had a laboratory with assistants and was able to do some very good work.

Koch first thought of the covered dish and the gelatine soup used for cultures. He also invented micro-photography so that photographs of very small microbes could be taken. He discovered the germ that causes cholera, and found that the disease is caused by drinking bad water.

It would be impossible to tell the story of Pasteur without a short account of his final victory.

Pasteur was always ready to defy difficulties. Having discovered the principle of immunisation, he decided to use it to conquer one of the most terrible diseases in the world, and one that was especially difficult to fight. This was HYDROPHOBIA.

The cause of hydrophobia was well known. It came from the bite of a mad dog. Ordinary bites do not cause it. In the dog the disease was known as RABIES.

PASTEUR AND THE LITTLE BEASTIES

Fortunately not many people died from the disease. There are very, very few mad dogs. But it was just this factor that made it difficult to cure. It was useless to attempt to vaccinate children so that they would never suffer from the disease. People would not suffer the discomfort when the chances that they would suffer from hydrophobia were so small.

Pasteur would need to find a vaccine that he could inject after the dog bite had occurred. As it happened, there was a long period after the bite before the victim suffered the first symptoms of the disease. If Pasteur were to succeed he must inoculate the patient during this time.

After a great number of experiments Pasteur found the vaccine he needed. He found the correct doses, although as many as ten were needed.

But now came the final test. He must use the vaccine on a person bitten by a mad dog.

On July 7th 1885 an Alsatian boy, Joseph Meister, was brought to Pasteur. The boy had been bitten a number of times by a dog known to be suffering from rabies.

Pasteur went through the process that he had already planned. He decided to give thirteen inoculations to be on the safe side. On the fourteenth day he gave the strongest injection of all. The hydrophobia germs were beaten, and the boy lived.

Very soon afterwards, and before France had really learnt about his success with the young Alsatian, a brave shepherd boy was brought to Pasteur to see if he could prevent the dreaded hydrophobia from attacking the youth.

This national hero, Julippe, had faced and fought a dog which had attacked his friends. He had finally wrestled with the dog and killed it, but not without a severe mauling. He was brought to Pasteur, who could see at once that the boy had no chance unless he were vaccinated.

When it was finally known that the brave boy, Julippe, had been

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saved by Pasteur's vaccination, all the nation did the great chemist honour.

For some time after this people thought that Louis Pasteur had discovered the cure for all the diseases that afflict us. Pasteur himself knew that this was wrong. He knew that many diseases defy inoculation. Many diseases cannot be cured by inoculation today.

But Pasteur and the principle of immunisation have conquered many diseases that once threw a shadow across the lives of men. Among these are diphtheria, yellow fever, typhoid and cholera.

And every time we drink pasteurised milk we remember Pasteur's work, for it was Pasteur who discovered that great heat will kill the little beasties in milk.

CHAPTER NINE

Lister and the Battle Against Germs

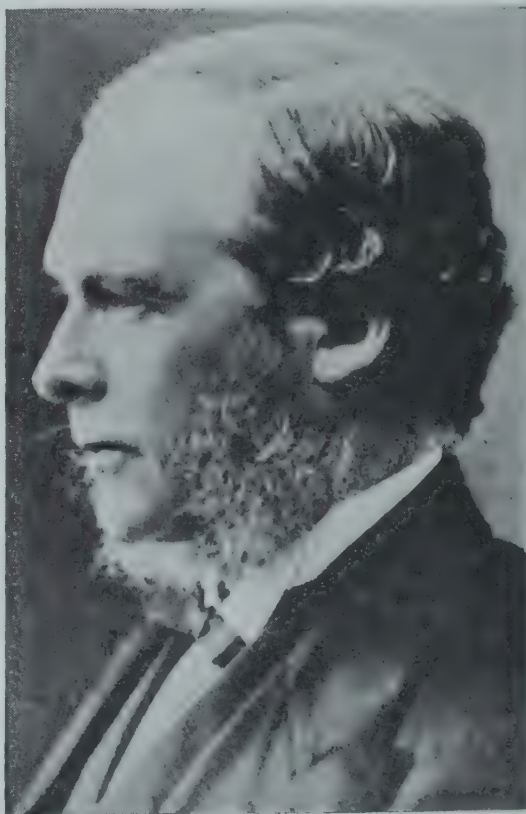
ON a cold winter's day in 1892 the great lecture-room in the Paris University was crowded with more than two thousand people. They were all scientists, doctors, chemists and important people from all over the world. They had come to do honour to Louis Pasteur on his seventieth birthday.

At last Pasteur came in leaning on the shoulder of the French President. After the cheering died down the important guests were introduced to Pasteur.

One of the first was a tall, handsome Englishman. He announced himself as Lord Lister, bringing the greetings of the Royal Society of England.

There was a fresh outburst of cheering, which became even greater when Pasteur stepped forward and put his arms around Lord Lister.

Then Lister told the assembly how much surgery owed to Pasteur.



Lord Lister

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It was true. If it had not been for Pasteur's work against microbes Lister would never have been able to carry out his surgical reforms.

Joseph Lister was born in 1827 in London. His father was a Quaker and a wealthy wine-merchant. He was able to send young Lister to a good school and university to learn Medicine.

Lister was a quiet, hard-working student. He had always wanted to be a doctor. He had always been interested in surgery, although the first operations he watched filled him with horror.

One day he was told that the great surgeon Liston was going to perform an operation upon a patient who was to be given an anæsthetic. Lister asked to be allowed to watch. He saw the anæsthetic gradually overcome the young man on the operating-table. Then he watched, fascinated, while Liston operated upon the leg of the sleeping patient.

Lister walked away from the operating-room that day convinced that he had seen the first operation in a new era of surgery.

While the use of anæsthetic took the agony from operations, surgery claimed more lives than it had ever done before. More operations were attempted. Surgeons could undertake operations that would have been impossible before. Simpson, who discovered chloroform, said sadly:

"A man laid on the operating-table in one of our surgical hospitals was exposed to more chances of death than the English soldier on the field of Waterloo."

Lister soon discovered that this was true, especially when he became the Chief Surgeon at Glasgow Royal Infirmary.

At that time this hospital had the worst reputation in the country. If a patient was told that he was being sent there he felt that he was being condemned to death. The hospital was built over an old burial ground where the victims of a cholera epidemic had been buried. Some people blamed this for the bad reputation of the hospital.

LISTER AND THE BATTLE AGAINST GERMS

But the fault was in the hands of the doctors themselves.

The doctors were not aware of the importance of cleanliness. They passed from bed to bed, examining the patients, and touching septic wounds without washing the germs from their hands. They carried the microbes of disease from one patient to another.

The nurses were as bad. Bandages were used again and again. Wounds were not cleaned. When the wound became inflamed no one recognised the danger signal.

When a wound becomes infected it passes through several stages. First the skin becomes red. Then there is swelling. Finally, pus oozes from the wound. This is a very bad sign; and if the wound is not attended at once the patient can lose a limb or even his life.

Doctors did not understand this. So many wounds became inflamed and full of pus that they thought it was quite natural. They thought pus cleaned a wound as a tear cleans the eye.

Surgeons performed operations with dirty hands and dirty knives. Dirty cloths were used to wipe away the blood. The surgeon wiped his knife upon the old frock coat he wore at every operation. Surgeons did not know that there were germs on the knives, germs on their hands, germs on the old frock coat. They did not know that even their breath contained germs that could bring death to the patient whose life they thought they were saving.

Deaths from infection in hospitals were so common that people said they died of the "hospital disease". More people died of the



Joseph Lister 1827-1912

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hospital disease than died on the operating-table. One frantic surgeon said in despair that all the hospitals in the country should be torn down, and patients should be treated only in their own homes.

Perhaps a few surgeons wondered if dirt might be the cause of the trouble, but they did nothing about it.

Lister, walking through the wards of his ill-famed hospital, saw many cases of infected wounds. He observed and made notes of his observations.

He noticed that in every case the INFLAMMATION came first. He wondered why. He tried covering some of the wounds with clean bandage immediately after the operation. He found out that there was less chance of these wounds becoming infected.

Then Lister heard of Pasteur and the microbes. He guessed at once that this was the secret behind the dreaded disease. The more he studied the subject, the more certain he became.

Then he began the battle against the microbes of disease in the hospitals. He made it a rule that all surgeons and nurses had to wash their hands before examining patients. He made surgeons keep bowls of water in the operating-rooms. When their hands became dirty they had to wash. But this was not good enough. He knew that while the surgeon washed the dirt away, many germs remained on the hands. It was not so easy to get rid of those. He wanted something stronger than water to kill the germs.

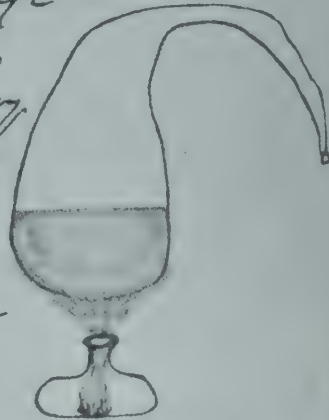
A friend told him that an engineer in Carlisle used carbolic acid to kill the smell of sewage. Lister tested the liquid and thought that it might act as a purifier.

It was sprinkled on the floors of the wards, splashed on the patients' sheets and sprayed on bandages. But Lister felt that it could kill the germs on the patients' wounds only if it was placed on the wounds themselves.

In Lister's day a patient who had suffered an open FRACTURE of the leg was usually doomed. The broken bone had pierced the skin,

249.

air but the solids which cause the decomposition. Take any fermenting liquid say wine, and place it in a flask with an extended neck so that the heat may be carried up to 212° ; and then apply a spirit lamp below the flask so as to expell the air and destroy any thing that may be alive in it. Take away the spirit lamp and the air will reenter, but any germs which may happen to pass up the tube will be killed by the heat. What will be the result?



You have let the air reenter but this air has been deprived of its germs and the wine in the flask will remain for any length of time, 20 years or more perfectly sweet because the air that is now in the flask deprived of its power of decomposition by being heated in a way calculated to kill any thing that may be alive in it.

Lister's description of his experiment in support of the antiseptic principle: these are notes taken by W. S. Anderson, a student of Lister's at Glasgow



Lister's carbolic spray in use during an operation

and that meant that germs could enter the open wound. Infection followed, making an amputation of the limb necessary. Lister decided to experiment on patients with compound fractures. He made a putty of chalk and carbolic acid which he placed on the wound. He covered this with a thin metal sheeting. The dressing would have looked very ugly to us now. But it proved successful, except that the patient complained of the pain, for the acid was too strong and burnt the skin.

Lister tried a weaker solution of carbolic acid. When that proved satisfactory he tried other experiments with carbolic acid sprays and specially treated adhesive plaster.

He found that he was getting good results. There was a sudden drop in deaths in the hospital. More and more patients recovered

LISTER AND THE BATTLE AGAINST GERMS

without the need of amputation. Other doctors began to talk about his experiments and to ask his advice.

At first people laughed at him, and then they said that his methods were stupid. But when they saw that success came as a result they began to follow his suggestions. Gradually the hospitals throughout the land became cleaner and safer places.

Lister was made a knight, then a baron and finally a peer. When it was decided to send someone to represent the Royal Society at Pasteur's birthday party, Lister was chosen by common consent.

Lister was the first surgeon to use the ANTISEPTIC methods. Now surgeons and nurses in the operating-room have to wash their hands often. All their instruments are passed through boiling water. Masks are worn. It is extremely rare for wounds to become infected. There is no disease known as "hospital disease" in the hospitals today.

The great value of Lister's work is that he pointed out the great value of cleanliness and ASEPTIC methods in Medicine.

CHAPTER TEN

Medicine and Science

THE work of Pasteur and Lister marks the great change in the practice of Medicine that came at the end of the nineteenth century. Before Lister's time Medicine was still treated as a mystery, as something akin to witchcraft. No one knew how diseases came. The doctors did not know why some medicines cured and others did not. They prescribed medicines mainly because other doctors had tried them and found that they acted. If the medicine cured one disease they tried the same medicine on another patient to cure a completely different illness.

Pasteur turned diagnosis from an art into a science. Using Lister's aseptic methods, surgical operations could be performed that had never been attempted before. The practice of Medicine became a science.

Once doctors understood how most diseases began, they could seek a cure for these diseases. Using the methods of Pasteur, doctors and scientists all over the world have experimented in their laboratories, fighting disease. But the knowledge of Medicine became more and more difficult: there was too much for one man to learn in his lifetime. So doctors have specialised in one subject, one disease, one part of the body.

Doctors specialised in skin disease, the brain, the heart, the kidneys, the liver or the bone structure of the body. Others have tried to invent better equipment for the hospitals. Some have specialised in tropical diseases, which occur in hot countries, and some in the sicknesses that affect children.

MEDICINE AND SCIENCE

It would be impossible to describe all the discoveries that have been made in the last fifty years—the Golden Age of Medicine. But among them all there are some that must be remembered.

The X-Rays

One November day in 1895 a German scientist named Wilhelm Röntgen was carrying out an experiment in a very dark room.

For this experiment he had a cathode-ray tube, the tube that gives you your television picture. This was screened by a black piece of cardboard so that when the electricity was switched on and the tube began to glow, no light could be seen.

He switched on the electricity. No light came from the tube, but a piece of paper glowed brightly in the corner of the room. He inspected the paper and saw that it had been painted with a chemical on one side. Fresh experiments showed him that the paper only glowed when the electricity was switched on and when it stood in a direct line to the tube. If any barrier was placed between, the paper still glowed, but in some cases a shadow was thrown on the paper which was the exact shape of the barrier.

The final experiment came when he placed his hand in the way of the peculiar light and the bones showed up clearly as sharp shadows on the paper.

He knew that in some strange way mysterious rays of light were passing through objects in the way and showing clearly on the treated paper. These mysterious rays he called X-RAYS.

Probably Röntgen never knew how much his X-rays helped surgery and all medical practice.

Doctors had always faced the difficulty that they worked blind. They could not see what was wrong inside the body until the operation was on the way, and then they had to make big decisions in a hurry. If only, they had thought many a time, if only they had known what was wrong first.

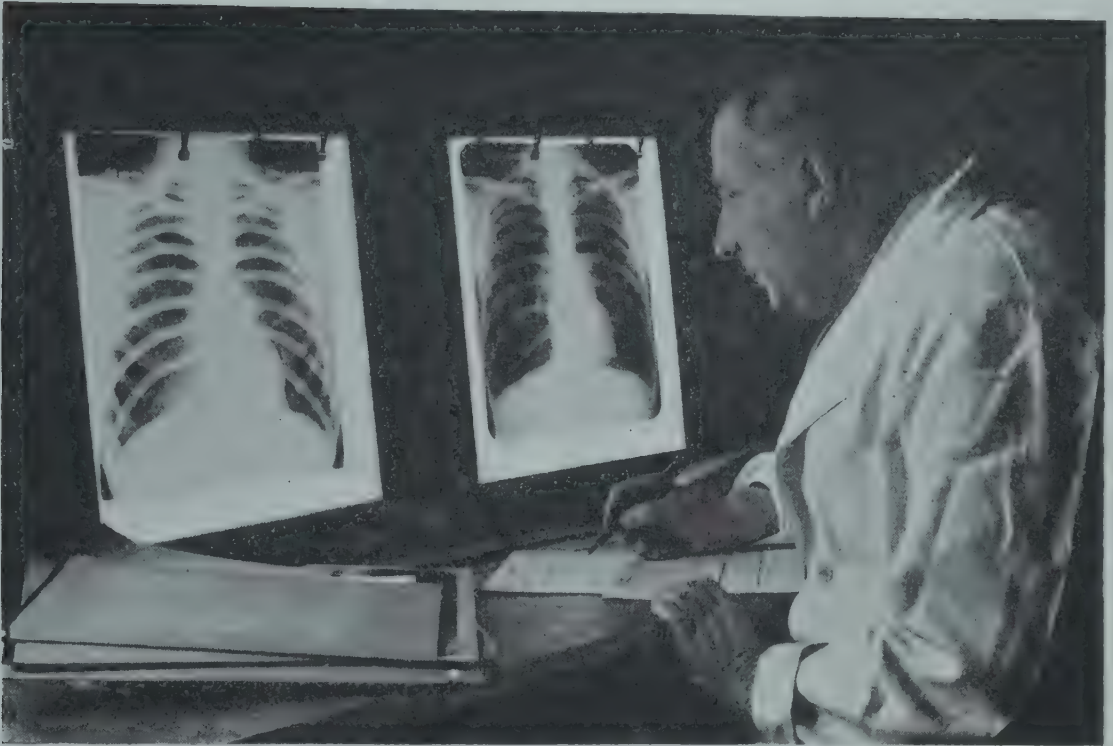


Modern X-ray outfit

The X-rays made it possible for the doctor to know what was happening before the operation. If a child breaks a leg today, he is often placed on a special bed so that the doctor can see the shape of the broken bone by means of the X-ray machine. Even after the bone is set it can be seen quite easily through the bandages and the flesh by means of X-rays. The doctor can make sure that it is joining correctly.

Sometimes the patient has to have a special drink, usually bismuth. This drink is unpleasant, but it has a very special quality. It shows up clearly in the X-rays. This bismuth travels through the bowel and the X-ray camera can take photographs. Afterwards these photographs showing the inside of the body can be studied by the doctor and he can see what is wrong with his patient.

X-rays have been used to check the terrible disease of TUBERCU-



X-ray photographs

LOSIS. This is not a fatal disease if it is discovered in time. Now the X-ray camera goes into workshops and schools for people and children to have a routine examination. If the marks of the disease show on the photograph the patient is given treatment at an early stage of the disease and cured.

This is only one of the many ways in which X-rays have saved thousands upon thousands of lives.

The Curies and Radium

Perhaps Pierre and Marie Curie did not fully realise what their discovery of RADIUM would mean.

It was soon after the discovery of the X-rays that Marie began her experiments. Pierre helped her, and just at the moment of

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Pierre and Marie Curie at work

success was killed in a tragic road accident.

Marie continued with her experiments, and at last succeeded. Radium could be used for treating the terrible illness of cancer. But later it became useful for other diseases, such as ANÆMIA.

Now radium is a part of RADIO-THERAPY treatment. Specialists use it in conjunction with deep rays, and new radioactive substances, in the treatment of cancer and other illnesses.

The Battle Against the Swamps

More than one hundred and fifty years ago two Jamaican doctors fought a duel in which both were killed. They fought for a very peculiar reason. One said that if a man suffered from yellow fever he spread it among his neighbours. The other said that that was impossible. The disease was not infectious. If a man had yellow fever he died and was in his grave long before anyone else in the same district suffered from the same fever.

The two duellists were both right and both wrong. They were not the only men to quarrel about the same subject, although most doctors quarrelled by word rather than by sword.

The hot countries suffered from diseases known as tropical diseases. The worst ones were MALARIA and YELLOW FEVER. When Europeans began to travel all over the world and set up colonies they suffered a great deal from these terrible diseases. As they had

MEDICINE AND SCIENCE

never met these fevers in their own countries, they did not know the cure. They did not even know the cause of the diseases.

These tropical diseases differed from many European plagues because there was a time lapse. It was a fortnight after the first sufferer died from yellow fever before the next patient became ill.

This was as much a danger as it was a mystery. At the first sign of illness the whole village was deserted. The villagers went to other districts—and the disease went with them. When travellers came and went in ships they carried the disease on.

It was in the fifteenth and sixteenth centuries that Europeans began to explore the hot countries. They feared the onslaught of strange beasts and dragons. They found instead that their worst enemies were the epidemics of malaria and yellow fever and other tropical diseases.

The tropical countries were explored, fought over and finally became colonies. But still men died from the fevers, and the mystery of their cause and cure still went unsolved.

The one medicine that proved effective for malaria was almost as much a mystery as the disease. This was a drink distilled from CINCHONA BARK. It was called QUININE, and among the doctors to



Areas of tropical diseases

MEDICINE

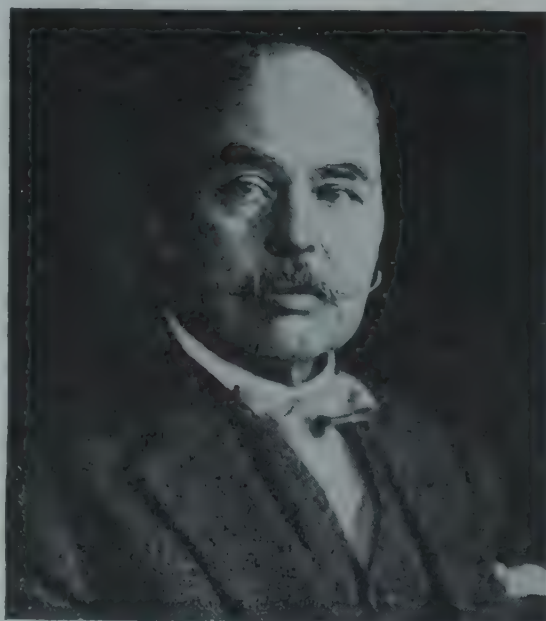


*Sir Patrick
Manson*

advise its use was Sydenham. It cured but did not prevent the disease, and once a man suffered from an attack of malaria he was liable to suffer again and again from the same disease.

The mystery of malaria was only solved fifty years or so ago. First a French army surgeon named Laveran discovered that there were tiny PARASITES in the blood of patients suffering from malaria.

Sir Patrick Manson, a British expert on tropical diseases, showed these parasites to a young doctor in the Indian Army. He also suggested that these parasites might have come from an insect like a MOSQUITO.



Sir Ronald Ross



Collecting mosquito larvæ in a Malayan breeding place

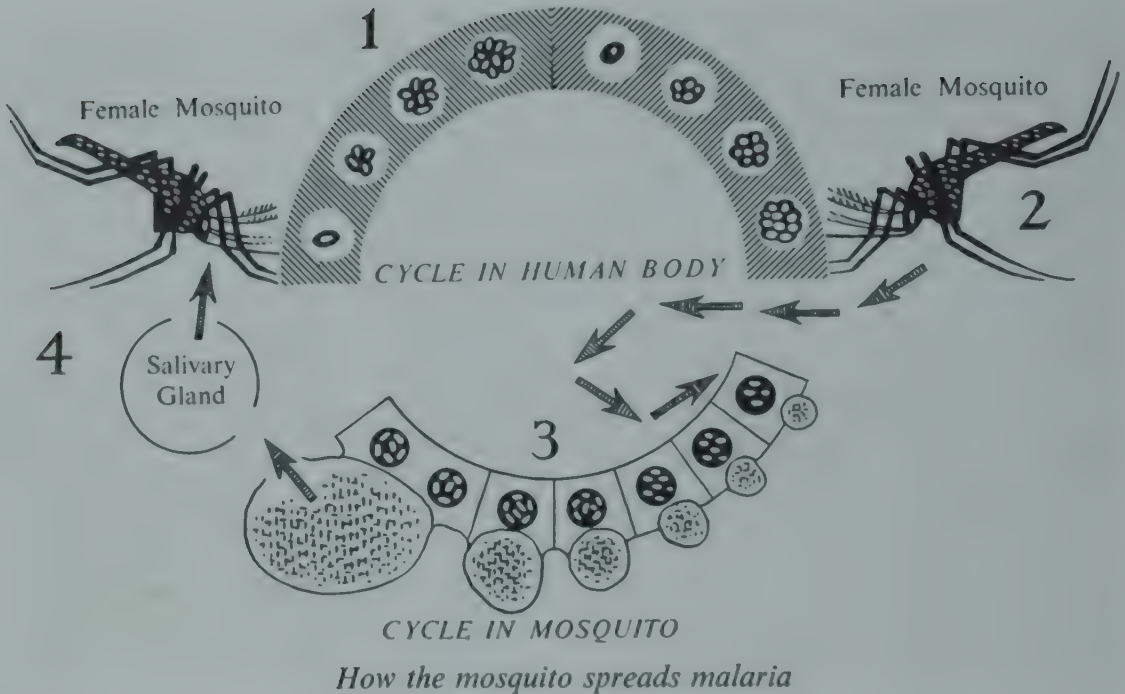
The interest of Ronald Ross, the army doctor, was quickened, and he began a great search for the mysterious cause of malaria.

He caught, split open and examined hundreds and thousands of mosquitoes. On August 20th 1897 he discovered the whole secret. One kind of mosquito contained in its stomach the same parasites as a sufferer from malaria.

But that was not the end of the search. How did the parasites get from the mosquito to the patient? The patient was bitten it was true, but that did not mean that the parasites just travelled from the mosquito to the man. At last Ross discovered that there were a number of stages. The mosquito contained the germs. The mosquito bit the man and left the parasite eggs in the blood. These hatched, grew and multiplied.

The discovery of the cause of malaria meant that its prevention was possible. Mosquitoes lived in swamps. These could be

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attacked. In some cases they were drained, dredged and turned into farms or villages. When this was difficult, paraffin was sprayed on the water to stop the mosquito laying her eggs.

Malaria and the other diseases which have similar causes—yellow fever and ELEPHANTIASIS—have not been got rid of completely, but fewer people suffer from these diseases every year, and in time they will be conquered.

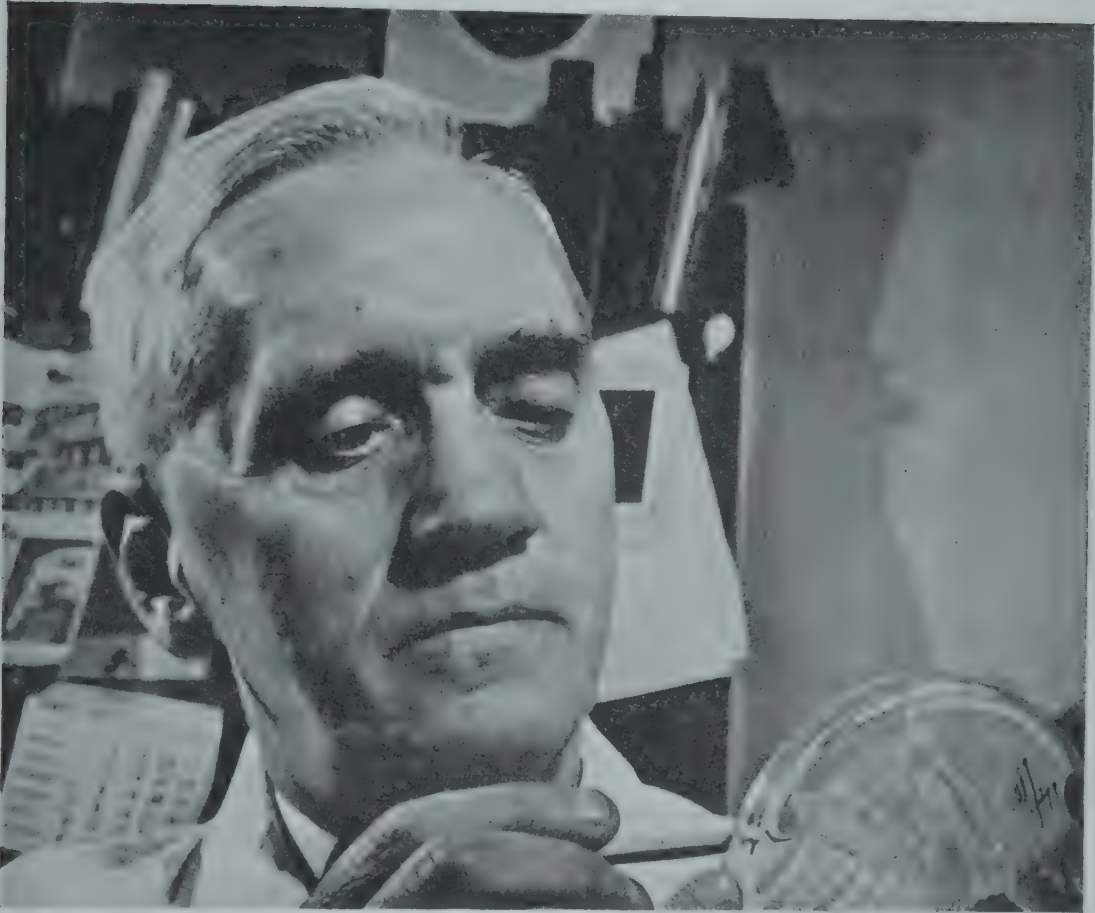
Penicillin

One of the greatest discoveries in recent years has been Sir Alexander Fleming's wonderful discovery of the drug PENICILLIN.

But there were many discoveries that led to this ultimate success.

Witches used herbs in their brews hundreds of years ago. The first doctor who turned medical men towards a fresh study of herbs was William Withering of Birmingham.

On one occasion he heard of an old woman who suffered from



Sir Alexander Fleming

DROPSY being cured by a witch. Withering managed to get the secret "cure". He tested most of the queer things in the mixture and found that the one herb which might help was foxglove leaf or digitalis. After a great number of experiments he wrote a small book about the use of the herb to help heart complaints.

That was the beginning, more than one hundred and fifty years ago, of a fresh interest in herbs and the drugs they made.

When Pasteur discovered that bacteria were the cause of so many diseases, doctors and chemists tried to find drugs that would kill these bacteria without killing the patient.

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One German doctor, Paul Ehrlich, said: "We want magic bullets to kill only the germs." He made drugs, not from herbs but from chemicals. His success led to other experiments in the laboratories where men were trying to make chemical drugs to fight the bacterial diseases.

Some famous laboratories had a number of successes with drugs using sulphur and nitrogen. Chemists liked to call these drugs by all the names of the chemicals used. So we get one drug called "2-(*para*-amino-benzene-sulphonamido) pyridine"! That was too long to use in the ordinary way, and we call it by the initials of the firm and the number of the line in the book in which it was first written—"M and B 693". And we call all the similar drugs sulphonamides.

These drugs were wonderful enough. They cured pneumonia and the fevers. But just before the Second World War penicillin was discovered, and that was an even greater chemical drug.

And yet in one way it is not a drug at all.

Alexander Fleming studied bacteria in St. Mary's Hospital in London. He was trying experiments to kill bacteria. He used a

great number of shallow dishes with covers. Inside was a jelly-like food for the microbes.



Fleming's original culture plate

One day Fleming saw that one of the covers had been left off a dish and a kind of mildew or mould was growing on the jelly. Most men would have thrown away the jelly and the mould, but a BACTERIOLOGIST loves to use his microscope to see what is happening.

Fleming saw that the mi-

MEDICINE AND SCIENCE

crobes were dead where the mould lay. This aroused his interest. He experimented, growing the mould in as many dishes as he could.

In 1929 he suggested that this mould, which he knew was called *Penicillium*, could be grown and used to kill microbes.

When other men heard of his experiments they agreed that if the drug—to be called penicillin—could be grown easily it might kill the microbes of many diseases actually in the body.

Experiments were continued in both this country and in America, which had been informed of the great discovery. Many lives were being lost because of the War, and it was necessary to produce large amounts of penicillin as soon as possible. At last it was possible to produce penicillin cheaply and in quantity.

Since that time there have been many similar moulds grown in chemical laboratories where men experiment all the while to find more of these magic moulds. These drugs have different purposes, but the principle is the same.

Penicillin is a natural antiseptic that can be taken by the patient without fear of ill results. It is used for the bacterial diseases. But it does not cure tuberculosis or diseases such as chicken-pox and measles.

It can be injected into the blood-stream or it can be used with beeswax as a paste. It can also be simply given by mouth.

The work of Pasteur in finding a method of preventing disease and the work of Lister in fighting our natural enemies with antiseptic methods led naturally to the discovery of penicillin, but if it had not been for Sir Alexander Fleming's observation and experiments we might never have had the wonder drug.

CHAPTER ELEVEN

Medicine Today

FRESH discoveries in Medicine are always being made. But we will never discover the secret of how to live for ever.

There comes a time in the life of every man or woman when the body does not work as well as it did. Our bodies are really very delicate machines. We take food for fuel. We breathe fresh air and enjoy the sunshine to keep our bodies in better trim. But sooner or later the organs of our body begin to wear out. It may be the heart, the kidneys, the blood-stream, the lungs; and sometimes when a person becomes very old, his brain may not work so well as it had formerly.

But many people die long before they grow old. There are deaths due to strain, when the body is asked to do more than it can. A man who is not too fit runs too hard, climbs too high or his body is exposed to severe extremes of weather.

Doctors cannot prevent these things happening. But by making a study of physiology they can help people to put their bodies to full use without over-strain. Doctor Roger Bannister studied his body and his leg and lung action to become the first man to run a mile in under four minutes. The Mount Everest climbers took doctors with them to make sure that they were fit when they attempted the climb, and to learn more about the human body working under strain at such heights.

There are also deaths due to accidents. People are injured or die because of accidents on the roads, at sea or in the sky. Every day men in dangerous jobs suffer accidents.

MEDICINE TODAY



Operating Theatre

While everyone tries to make travelling and machinery safe, it is impossible to avoid accidents. Then the hospitals and doctors try to mend the broken or burnt bodies. Some hospitals have a mobile accident team which knows exactly what to do in all kinds of cases. Recently there have also been many advances in treatment for burns.

But it is possible that there may come a time when people will not die from bacterial and VIRUS diseases, such as the fevers, typhoid, cholera, cancer, tuberculosis, poliomyelitis.

Pasteur and Koch showed the world what these enemies of men were. Lister told us how to prevent them harming us. Jenner showed the way to inoculation. Withering and Ehrlich gave us safe

MEDICINE

drugs to use. Fleming discovered a weapon against bacteria. Many research chemists are working every day in their laboratories to discover other weapons in the battle against disease.

Nevertheless, many people still die because of ignorance. They die because their bodies are not properly fed or properly treated. Many people die because of dirt.

Dirt is the friend of disease. We have learnt to keep our houses and our streets clean. We have learnt to drink only pure water. Sewage is taken away as quickly and as safely as possible. We rid our towns of the pests that harbour the germs of disease.

So, in a way, we are our own doctors.

For centuries Britain's medical service had been a voluntary one. The hospitals were maintained partly by charity, partly by large donations and by the patients who paid to be treated. Doctors and specialists were paid through some insurance or private scheme or



A modern Research Laboratory

MEDICINE TODAY



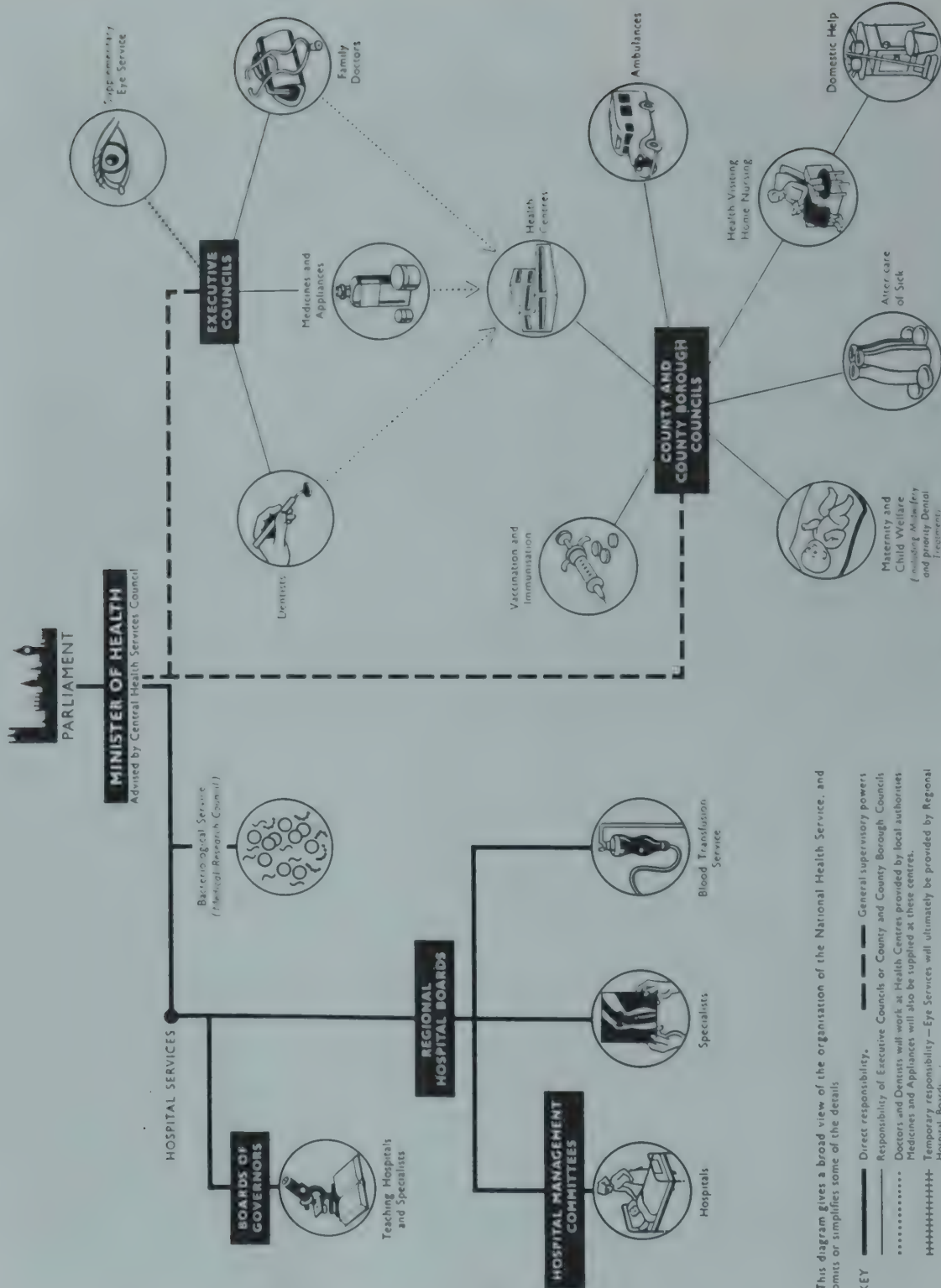
In the Clinic

by the fees of their patients. Some of the best hospital doctors were unpaid.

A National Health Service began in 1948. There could be private patients treated by doctors or given treatment in hospitals. But every wage-earner would pay a weekly insurance fee, a small part of which would entitle him to have treatment in State hospitals if he were unfortunate enough to become ill. Now the large hospitals became known as teaching hospitals, and infirmaries no longer existed in name.

The aim is for all people to feel that if they are ill they will be cared for properly at home or in the hospital, whether they have the money for treatment or not.

Doctors are trained in the Universities and in the Teaching



This diagram gives a broad view of the organisation of the National Health Service, and omits or simplifies some of the details

KEY

- Direct responsibility.
- - - Responsibility of Executive Councils or County and County Borough Councils
- Doctors and Dentists will work at Health Centres provided by local authorities
- Medicines and Appliances will also be supplied at these centres.
- Temporary responsibility — Eye Services will ultimately be provided by Regional Hospital Boards.

The National Health Service



Children's Ward

Hospitals. They then decide whether to become family doctors or to work in hospitals, or with public health departments. Instead of buying practices when they have qualified they can apply to serve in the areas which need doctors.

Although there has been a shortage of nurses, ever since the Second World War finished the training of nurses has greatly improved. The conditions of service are also better. Girls from Secondary Modern schools can become nurses, as well as the girls from the Grammar Schools. For the first year of training they must live in hostels attached to the hospitals. But they are paid a salary, and their training periods are laid down very carefully.

During the first years of their training nurses are given a complete picture of all hospital work. They do not specialise until they have

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obtained the magic letters "S.R.N." This means that they are fully qualified State Registered Nurses.

Medicine is not in the hands of the doctors and nurses alone. Today there are PHYSICISTS and chemists, PATHOLOGISTS, BACTERIOLOGISTS and PSYCHIATRISTS and very many other specialists all working for the welfare of man. They are not trying to repair the body alone. They are trying to prevent disease and illness. They are trying to give us healthier lives and healthier bodies. They are preparing for the babies to be born and taking care of the people who are too old to take care of themselves.

But whatever branch of Medicine they serve it is for the good of Man. They try to keep the oath that Hippocrates said all doctors should take:

"I will keep pure and holy both my life and my art."

GLOSSARY

ABSCCESS	a poisoned swelling on the body
AMPUTATE	to cut off, usually used in referring to a limb
ANAEMIA	an illness, a disease of the blood
ANAESTHETIC	a substance causing loss of the feeling of pain
ANATOMY	a study of the body
ANGELICA ROOT	a herb
ANTISEPTIC	a substance or method to prevent an infection or disease
ANTHRAX	a disease suffered mainly by cattle and sheep, but also occurring in man
AORTA	the main artery of the body
APOTHECARY	a person who sells medicines: used at one time to describe chemists
APPENDICITIS	an illness, the inflammation of the appendix, a part of the bowel
ARTERIES	the larger tubes that carry blood to all parts of the body
ASEPTIC	free from bacteria
AURICLE	a cavity of the heart
BACILLUS	disease germ, shaped like a long thin rod
BACTERIA	very small organisms that can be seen under a high-powered microscope; some are harmful and cause disease
BACTERIOLOGIST	a man who studies diseases caused by bacteria
BEZOAR STONE	substance supposed to have magical qualities
BLOOD-LETTING	taking blood from the body, once supposed to cure illnesses
BUBONIC FEVER	(the plague) an illness of the glands

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CESS-PIT	a pit for sewage and waste
CHLOROFORM	a liquid that causes unconsciousness
CHOLERA	an infectious disease caused by a germ spread in water
CINCHONA BARK	a tree-bark which gives a bitter medicine
CINNAMON	a spice used in medicine
CLINIC	a place where medical treatment is given
COCAINE	a drug to stop pain
CONVALESCENCE	recovery from an illness
COW-POX	a mild illness suffered by people who deal with cows
CULTURE	a growth of germs, carefully grown for some special purpose
DIAGNOSIS	to find out what is wrong with a sick person
DIPHTHERIA	an infectious disease suffered mainly by children, now rare due to immunisation
DISINFECTANT	a substance to kill germs
DISLOCATE	to put bones and joints out of place
DISSECTION	cutting up, especially of bodies to find causes of sickness
DROPSY	an illness, usually suffered by old people, which causes swelling
ELEPHANTIASIS	an illness which causes swelling—suffered by people in hot countries
EMBALMING	using spices and drugs to preserve a dead body
EPIDEMIC	the spreading of a disease
ETHER	a drug which makes people unconscious
FERMENTATION	change brought about when food or wine is stored
FESTER	the filling of a sore or wound with pus
FEVER	an illness, caused by germs, in which the patient becomes very hot
FRACTURE	broken or cracked bone
GENERAL PRACTITIONER	your own family doctor
GERMS	bacteria

GLOSSARY

GOUT	a painful disease of the joints
HERBALIST	a person who uses herbs to cure illnesses
HYDROPHOBIA	disease given to man by dogs suffering from rabies
HYGIENE	study of the methods to keep clean and healthy
IMMUNITY	a resistance of the body to bacterial disease
INFECTION	communication of disease
INFLAMMATION	diseased or sore part of the body which becomes hot and red
INSANITARY	not sanitary, that is—not clean, likely to cause disease
LAUGHING GAS	(nitrous oxide is the chemical name) a gas which causes unconsciousness
LENS	clear glass so shaped to make small things appear larger
LOTION	a liquid ointment
LUNGS	organs in the chest used for breathing
MALARIA	an illness like a severe cold suffered by people who live in hot countries
MANDIBLE	a jaw bone
MEASLES	an infectious disease which shows in spots on the skin; it can trouble the eyes
MICROBE	a very small germ, fungus or plant, too small to be seen with the naked eye
MICROSCOPE	an instrument which makes very small things appear sufficiently big to be seen
MOSQUITO	a very small insect which lives near water
MUMPS	an illness which causes swelling of the glands, usually in the neck and face
MYRRH	a gummy substance which gives a strong scent
NERVES	bundles of fibres in our bodies which give us our sense of feeling and help in movement of our muscles
OPERATION	thing done to some part of the body to remedy deformity or injury or to cure a disease
PARASITE	an animal or insect that lives on another

MEDICINE

PATHOLOGIST	a man who studies diseases
PENICILLIN	a medicine, made from a mould discovered by Fleming and used to treat certain bacterial infections
PHYSICIAN	a doctor
PHYSICIST	a man who studies the science of heat, light and sound
PHYSIOLOGY	a study of the internal working of the body
PLAGUE	a very infectious disease no longer suffered by people in this country
PLASTIC SURGERY	moulding skin and bone into another shape
PNEUMONIA	an illness of the lungs
POLIOMYELITIS	an infectious disease which can cause paralysis
POTION	a medical, magical or poisonous drink
PRESCRIPTION	written order for medicine, usually made out by a doctor for the patient
PROGNOSIS	the description of the natural development of a disease
PSYCHIATRIST	a person who studies the mind
PULMONARY ARTERY	the main artery taking blood from heart to lungs
PURGE	to empty, to clean out
PUS	the poisonous matter in sores and wounds
PUSTULES	small boils
QUACK	a dishonest person who pretends to be a doctor
QUININE	a bitter medicine used in the treatment of colds and malaria
RABIES	a disease suffered by a mad dog
RADIO-THERAPY	treatment of patients with radium, deep X-ray, or radio-active substances
RADIUM	a substance that gives off rays, used to cure disease
REMEDY	cure
RHEUMATISM	an illness which causes the joints to swell and to stiffen
SANITATION	ways to keep people and places clean and healthy

GLOSSARY

SCARLET FEVER	an infectious disease which makes the patient very hot and gives a rash
SERUM	the fluid left after blood has clotted; used in the prevention and cure of some diseases
SEWAGE	the waste from people and animals
SMALL-POX	a very infectious disease, now rare in Great Britain; prevented by vaccination; often kills the patient or leaves his skin badly pock-marked
SNAKE-ROOT	a herb
SPINAL CORD	the nerves in the backbone
SPLINTS	stiff material, usually wood, used to keep broken bones in position
SURGEON	a doctor who operates
SURGERY	treatment of illnesses by operation
TARTAR	waste substance that forms on teeth
TEMPERATURE	hot or cold; the body heat should be $98\frac{1}{2}^{\circ}$ F.
TREPAN	to cut away part of the skull
TUBERCULOSIS	a disease which causes wasting; it usually attacks the lungs
TYPHUS	a fever, now rare in this country, spread from patient to patient by fleas
VACCINATION	a method of protecting people against small-pox and other diseases
VEINS	thin-walled blood vessels carrying blood back to the heart from the body and lungs
VENA CAVAE	the main veins bringing blood back to the right side of the heart
VENTRICLE	a cavity of the heart
VIRUS	a disease-causing organism, so small that it can only be seen with the electron microscope; examples of virus illnesses are influenza, measles, chicken-pox, poliomyelitis, mumps etc.
X-RAYS	rays which make it possible to look through solid substances
YELLOW FEVER	a tropical disease spread by the mosquito

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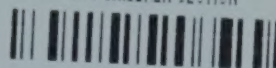
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